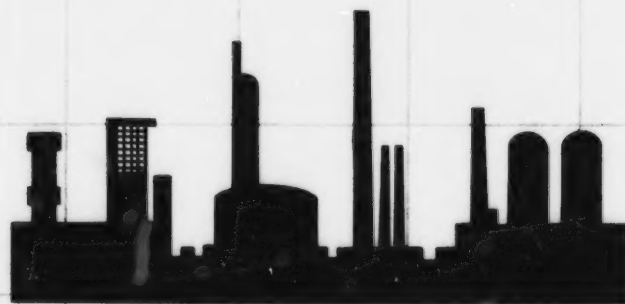

Heavy Industrial Land Use

A Regional Perspective



HEAVY INDUSTRIAL LAND USE

A REGIONAL PERSPECTIVE

Prepared by:
Edmonton Metropolitan Regional Planning Commission
General Planning Branch
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Edmonton Metropolitan Regional Planning Commission Staff

R. G. Madziya	Executive Director
Eugene L. Dmytruk	Manager - General Planning Branch
Jake Rudolph	Project Planner
Miles French	Planning Technologist (up to March 31, 1985)
Edith Huckle	Chief Draftsperson
Duane Riehl	Draftsperson
Jack Super	Printer
Ingrid Gruber	Information Processing
Susan Gravel	Information Processing

Other Contributions

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I Introduction

I. INTRODUCTION

1. Purpose and Scope

This study addresses heavy industry as a distinct form of industrial land use. It is one in a series of industrial land use studies prepared by the Edmonton Metropolitan Regional Planning Commission (E.M.R.P.C.).¹

The purpose of this study is to provide a comprehensive information base of heavy industrial land use in the E.M.R.P.C. Planning Region. Specifically, this report:

- (a) Inventories the location, extent and type of heavy industry in the Region;
- (b) Identifies the more pertinent land use issues associated with heavy industrial development; and
- (c) Includes a set of suggested actions or recommendations for the consideration of municipalities in planning for future heavy industry and nearby development.

It is hoped that the findings, conclusions and recommendations will benefit the Region's municipalities, the provincial government departments (e.g. Alberta Environment and Alberta Economic Development), other agencies involved in land use planning and/or economic development, and heavy industry (existing and potential). The threefold purpose, however, best compliments the information requirements of municipalities accommodating heavy industry and, as such, these municipalities are anticipated to be the report's primary users.

The comprehensive examination of heavy industrial land use is warranted for several reasons. First, the Edmonton Region accommodates one of the largest concentrations of heavy industry in Canada, including petrochemical plants, oil refineries, gas plants and to a lesser extent cement plants, steel and other large fabrication facilities. Notwithstanding the extent of heavy

-
1. Other recent reports in this series have included inventories of general industrial land use (light and medium industry) in both the Region's urban and rural municipalities.

E.M.R.P.C., General Industrial Land Use, An Inventory Within the Counties of Leduc, Parkland, Strathcona and the M.D. of Sturgeon 1983, Edmonton, 1984.

E.M.R.P.C., General Industrial Land Use, An Inventory of Urban Municipalities in the E.M.R.P.C. Region, 1983, Edmonton, 1984.

industry, a comprehensive information base of such uses has not previously been available for the region. The availability of such information will assist in identifying issues, assist in assessing the effectiveness and relevance of General Municipal Plan and Regional Plan policies, and will be beneficial in marketing the Region for continued heavy industrial growth. The inventory component of this report achieves this purpose.

Second, heavy industry is a form of industrial land use with unique site and resource requirements and land use impacts on other land uses. Heavy industry often requires large tracts of land, access to large volumes of water, rail and truck access and separation from residential and institutional forms of development. The issue component of this report examines the requirements and impacts of heavy industry and identifies the land use issues. The identification and discussion of relevant issues illustrates the off-site and often inter-municipal impacts of heavy industry, serves as a technical information base to assist municipalities in implementing Regional Plan policies and identifies aspects of heavy industrial land use which may require further investigation.

Third, it is important that municipalities, the E.M.R.P.C. and other land use planning authorities, have a working knowledge of the more important heavy industry issues to be addressed and the means by which this might be achieved. The conclusion to this report contains recommendations which are intended to assist municipalities in facilitating the continued growth of heavy industry and nearby uses in an orderly and beneficial manner.

2. Method

This report has been developed from a variety of information sources (see footnotes and bibliography) through an extensive process of research, fieldwork and consultation. The E.M.R.P.C. has had considerable experience in addressing the subject of heavy industry and Commission files have therefore served as a primary source of information.

The first and most fundamental exercise in undertaking this study has been to define what heavy industry is. The term "heavy industry" does not refer to a single type of industry but rather a variety of industrial activities with certain characteristics in common. For example, the Edmonton Metropolitan Regional Plan defines heavy industry as follows: (see also Appendix I)

HEAVY INDUSTRY: any manufacturing or processing activity:

- (a) which may consume large amounts of land, energy, water or other natural resources in its operation, or which requires

access to transportation facilities capable of handling bulk materials and commodities; or

- (b) which may have a detrimental effect on the environment through the following: high volumes of heavy vehicle movement; pollution of air, soil, or water; nuisance as a result of noise, smoke, odour, dust, fumes, glare or humidity; or hazard arising from fire, explosion, radiation or contamination.

Heavy industry does not have a standard set of characteristics or size. Heavy industry can include very large or quite small, industrial facilities. In addition, the difference between heavy industry and medium industry is a "grey area" subject to interpretation. The emphasis here is upon large scale heavy industry.

The majority of heavy industry is located in two areas of the Region - the area between the City of Edmonton and Sherwood Park (in the County of Strathcona) known as "Refinery Row" and second, the northeast area of the Region, including portions of the City of Fort Saskatchewan, M.D. of Sturgeon and County of Strathcona. For the purpose of this report, the latter is referred to as the "Northeast Industrial Area".

Upon definition of the form and location of industry to be investigated, the information inventory was developed through field surveys and examination of Commission files and all General Municipal Plans and Land Use By-laws. This inventory formed a basis for issue analysis which in turn formed the basis for suggested actions as contained in the Conclusion.

This report, therefore, consists of an integrated and logically developed set of information and discussion. The report has not investigated all land use related issues associated with heavy industry but has identified issues where further examination may be beneficial. The Appendices contain more detailed information provided in support of the main report.

II Inventory

II. INVENTORY

1. Historical Overview

The present distribution of heavy industrial land uses within the Edmonton Region is the product of nearly 40 years of development. Following the discovery of oil at Leduc in 1947 and at Redwater in 1948, the Region became established as an operational base for the oil and later the petrochemical industry. Oil companies and other related industries were guided by the provincial government to locate east of the City of Edmonton to what was the Municipal District of Strathcona.

In 1948, Imperial Oil Limited built the first oil refinery 2 miles east of the City of Edmonton. This was followed in 1951 by what became the Gulf Canada and the Texaco Canada refineries. Building Products of Canada opened in 1951 and Interprovincial Pipeline also opened a tank farm that same year. In 1952, the first petrochemical plant built was Celanese Canada Inc. followed by C-I-L Inc. in 1953 with a polyethylene plant.² These plants formed the early basis of heavy industry in the Edmonton Region in an area which is now known as "Refinery Row". The growth of Refinery Row has continued over the years with several expansions of existing plants, the addition of more tank farms, other heavy industries and many industrial parks accommodating related light and medium industries.

In 1954, Sheritt Gordon Mines opened a petrochemical plant adjacent to Fort Saskatchewan. Dow Chemical of Canada built a second chemical plant at Fort Saskatchewan in 1964 followed by Thio-Pet in 1965. These plants formed the nucleus of a second, more dispersed heavy industrial area, referred to in this report as the Northeast Industrial Area. In 1968, Esso Chemical Canada built a fertilizer plant in the M.D. of Sturgeon north of Fort Saskatchewan and south of Redwater. The construction of the Diamond Shamrock Plant at Scotford, northeast of Fort Saskatchewan in 1979 was the first heavy industrial development in the County of Strathcona outside of Refinery Row. In 1984, two more heavy industrial plants commenced operations in the Scotford Area, the Shell Canada Refinery and the Shell Styrene Plant to its immediate north.

With the exception of gas plants which are scattered throughout the Region, most other heavy industry is presently found in the industrial areas of the City of Edmonton.

2. Strathcona Industrial Association, Submission to the Local Authorities Board, (Edmonton Annexation Hearing), June, 1980.

2. Existing Distribution of Heavy Industrial Land

Map 1 illustrates the heavy industrial districts as identified in municipal statutory plans. The larger areas are now found in the Northeast Industrial Area, and particularly within the County of Strathcona and M.D. of Sturgeon.

Map 2 illustrates the distribution of all the larger heavy industrial plants, including gas plants. The pattern clearly shows the concentration in Refinery Row, between the City of Edmonton and Sherwood Park, and its separation from heavy industry in the Northeast Industrial Area.

(a) Heavy Industrial Land by Municipality

A total of 10,878 hectares (26,880 acres) are designated for heavy industrial use in the Region of which approximately 8,996 hectares (22,229 acres) or 82.7 percent are found in the Northeast Industrial Area. The largest single concentration of heavy industrial zoning is found in the Scotford area where 5,002 hectares (12,360 acres) or 46 percent of the Region's total heavy industrial land is found. The M.D. of Sturgeon also has a large area protected for heavy industrial use, however, the Land Use By-law designates 1,376 hectares (3,400 acres) of a total of 3,061 hectares (7,564 acres) as Potential Heavy Industrial, a unique land use classification.

(b) Total Area Owned by Existing Heavy Industry

Table 1 also identifies the total area owned by existing heavy industry. The figures provided are estimates only and do not include or account for many smaller scale heavy industries found within the City of Edmonton. Nonetheless, the estimates provide a reasonable indication of the amount of heavy industrial land owned and occupied within each applicable municipality. A total of 2,379 hectares (5,879 acres) or 59 percent of the Region's total heavy industrial ownership is in the Northeast Industrial Area spread amongst three municipalities. Within Refinery Row are found 1,658 owner occupied hectares (4,097 acres) or 41 percent of the Region's total.

Heavy industries within the M.D. of Sturgeon, the City of Fort Saskatchewan and the City of Edmonton currently utilize most of their existing properties and have little room for future expansions. This contrasts with heavy industry in the Scotford and Sherwood Park areas of the County of Strathcona which currently hold relatively large areas for potential future development.

(c) Total Area Designated and Not Owned by Heavy Industry

Sixty percent of the total area designated for new heavy industry is found in the Scotford area of the County of Strathcona, 39 percent is found in the M.D. of Sturgeon (though over half of this or 20 percent is designated Potential Heavy Industrial) and only 1 percent located within the City of Edmonton.

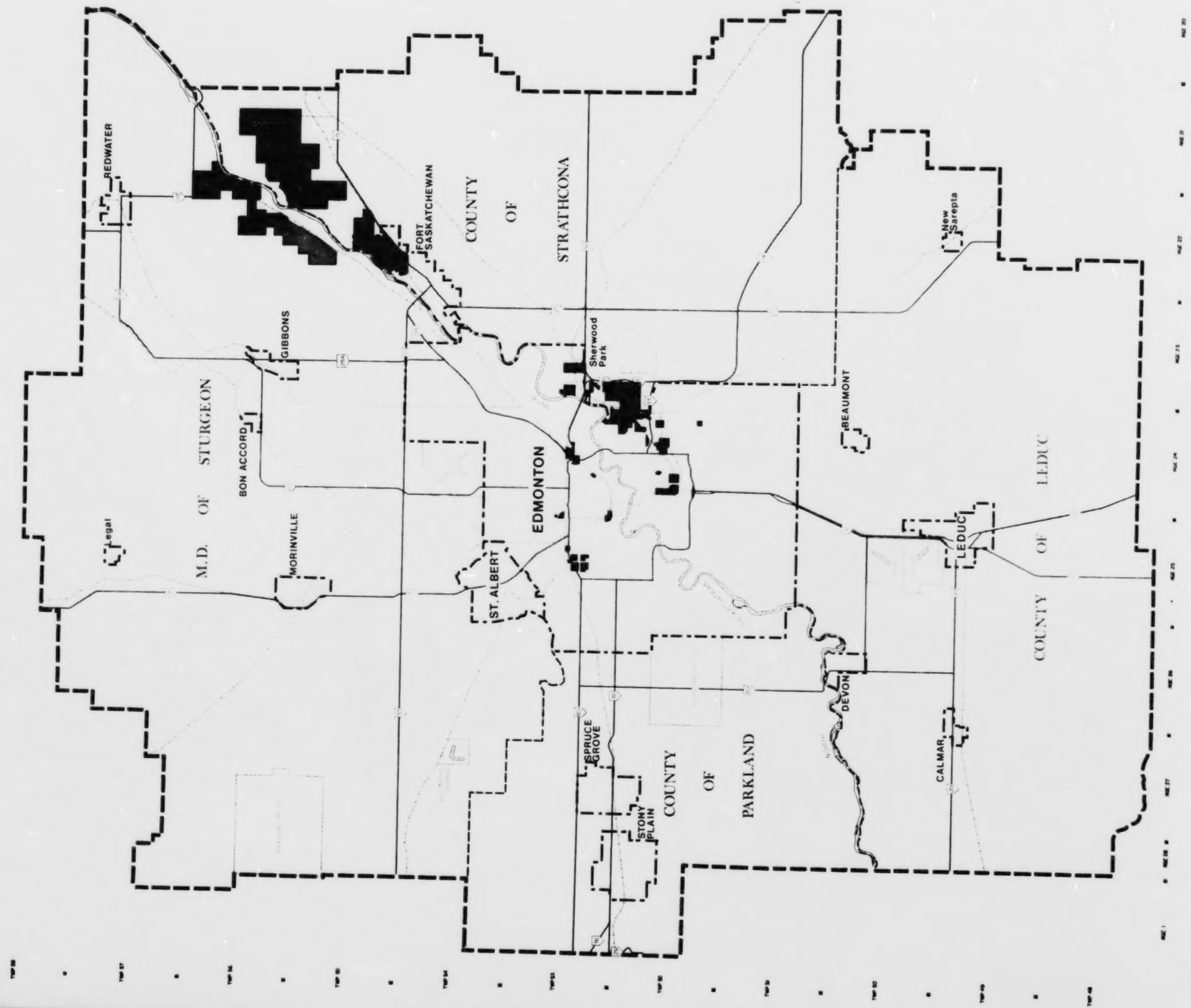
TABLE 1
HEAVY INDUSTRIAL LAND IN THE E.M.R.P.C. PLANNING REGION
(in hectares)

MUNICIPALITY	TOTAL AREA DESIGNATED HEAVY INDUSTRIAL ^a	TOTAL AREA OWNED BY EXISTING INDUSTRY ^b			TOTAL AREA DESIGNATED AND NOT OWNED BY EXISTING HEAVY INDUSTRY (Vacant)
		Developed	Vacant	Total	
M.D. OF STURGEON	3,061	419	30	449 ^d	2,628
COUNTY OF STRATHCONA					
Scotford Area ^c	5,002	324	673	997	4,005
Sherwood Park	1,001	611	551	1,162	-
Total	6,003	935	1,224	2,159	4,005
CITY OF FORT SASKATCHEWAN	933	817	116	933	-
CITY OF EDMONTON					
Areas annexed in 1982 only	366	417	79	496 ^f	-
Excluding annexed areas	515	not available			98
Total	881	not available			98
REGION TOTAL	10,878	2,588	1,449	4,037	6,731

1 hectare = 2.471 acres

Footnotes

- (a) The total area designated for heavy industry in land use bylaws. Includes 1,376 hectares (3,400 acres) designated for Potential Heavy Industrial in the M.D. of Sturgeon. Excludes railway lands within DC-4 District in the City of Edmonton.
- (b) The total of all lands owned by those heavy industries with existing plants and facilities. The amount of land developed and vacant has been estimated through air photo interpretation.
- (c) Includes heavy industrial land owned by Dow Chemical and Dome Petroleum adjacent to the Town of Fort Saskatchewan.
- (d) Includes land owned by Alberta Food Products and Procor Ltd. which is not zoned heavy industrial.
- (e) Includes land owned by Gulf Oil and Truroc Gypsum which is located within the Restricted Development Area.
- (f) Includes 81 hectares associated with the Inland (Genstar) Cement Plant in the northwest part of the city.



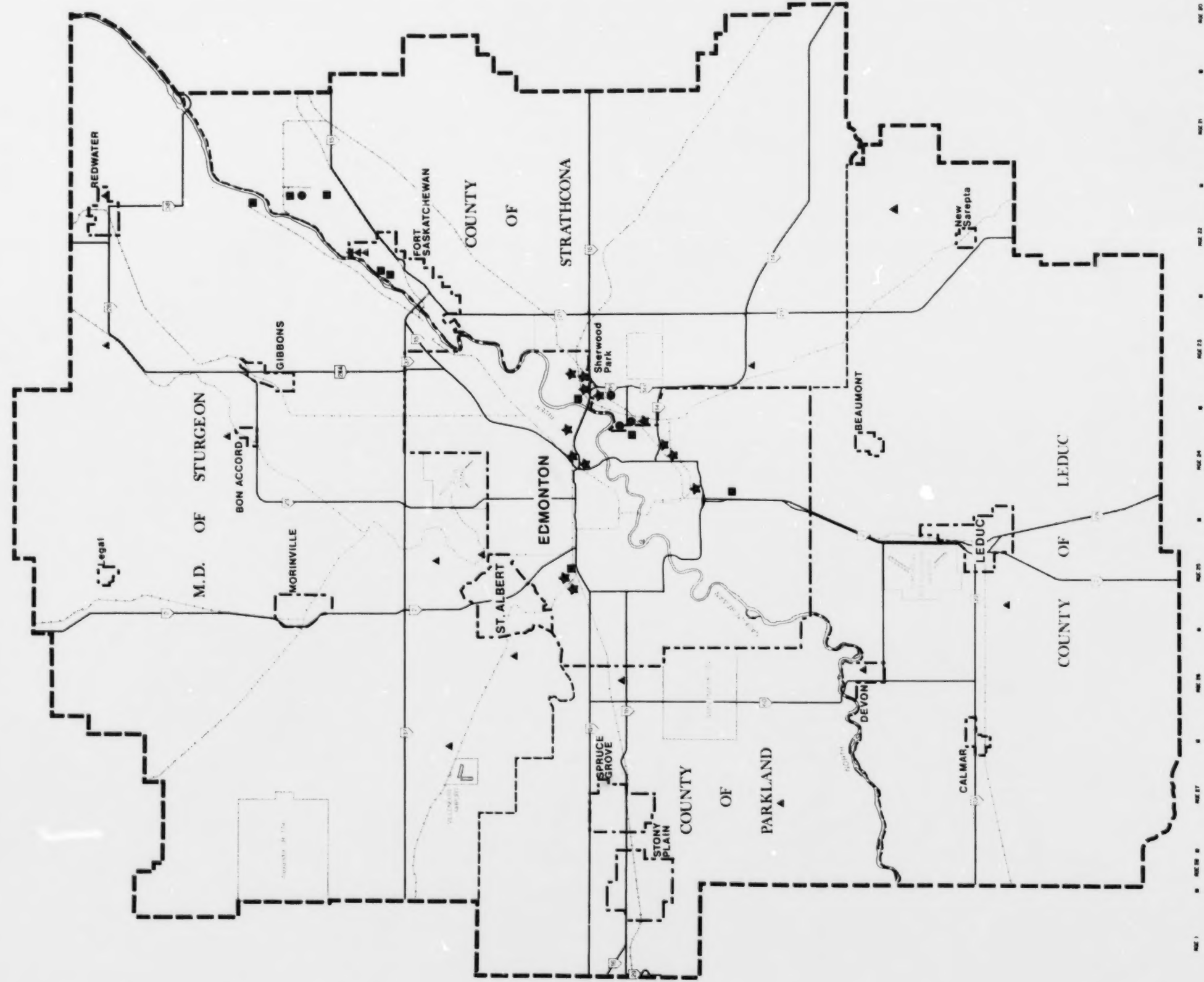
Major Areas Designated for Heavy Industrial Land Use E.M.R.P.C. PLANNING REGION

- HEAVY INDUSTRIAL AREAS
- POTENTIAL HEAVY INDUSTRIAL AREA
- EMRPC BOUNDARY
- URBAN MUNICIPALITY
- RURAL MUNICIPALITY

Note: Small heavy industrial lots in the City of Edmonton are not illustrated due to the scale of map.
For details on the City of Edmonton please refer to the Land Use Bylaw.

Source: City of Edmonton, City of Fort Saskatchewan, County of Strathcona, and M.D. of Sturgeon, Land Use Bylaws.





Major Heavy Industrial Sites E.M.R.P.C. PLANNING REGION

- ▲ GAS PLANT
- OIL REFINERY
- PETROCHEMICAL PLANT
- ★ OTHER
- EMRPC BOUNDARY
- URBAN MUNICIPALITY
- RURAL MUNICIPALITY

Note: Map 2 illustrates the existing general location and pattern of major heavy industrial sites in the Region and does not include smaller heavy industry which is primarily concentrated in the City of Edmonton.

Source: Edmonton Metropolitan Regional Planning Commission

(d) Total Designated Land - Developed and Vacant

A final comment on Table 1 pertains to the total amount of land designated which is developed as opposed to vacant. Of the 10,878 designated hectares (26,880 acres) in the Region, 62 percent or 6,731 hectares (16,632) are vacant and the remainder are occupied by heavy industry or some other use. Within the owner occupied properties, a further 1,449 hectares (3,580 acres) is vacant and potentially available for future heavy industrial use. While some of this land may not be designated heavy industrial, most of it can be used for related uses.

A total of 8,180 hectares (20,212 acres) is therefore available for further heavy industrial development. This compares to an estimated 2,588 hectares (6,395 acres) which are currently developed. Assuming the existing vacant heavy industrial land is located in areas suitable to potential new heavy industries, the existing supply of heavy industrial land in the Region should be adequate for a long term period.

3. Heavy Industry According to Area and Municipality

This section provides a description of the number and type of heavy industrial plants or owners found within the M.D. of Sturgeon, County of Strathcona, City of Fort Saskatchewan and a sample of those found within the City of Edmonton.

Tables 2 and 3 document the name, area, location and type of heavy industrial uses. Maps 3 and 4 illustrate heavy industrial properties and districting for Refinery Row and the Northeast Industrial Area respectively.

(a) Refinery Row and City of Edmonton

Map 3 illustrates the Refinery Row area which includes portions of the City of Edmonton and Hamlet of Sherwood Park within the County of Strathcona. The greater part of Refinery Row remained within the County of Strathcona following the major annexation of land to the City of Edmonton on January 1, 1982.

Within the County of Strathcona portion of Refinery Row are found the Imperial Oil, Gulf, and Texaco refineries (the latter is presently not operating), several tank farms, the Stelco steel plant, the Alcan coker facility, and some other smaller scale heavy industries.

It should also be noted that the larger vacant properties in the area are owned by Texaco, Shell, Stelco and Gulf.

The City of Edmonton portion of Refinery Row includes two petrochemical plants, Celanese Canada and C-I-L, a large cement plant operated by Canada Cement LaFarge, numerous smaller scale plants producing fiberglass, gypsum, building products and steel, and property owned by Esso Petroleum Canada which is used for uses ancillary to its refinery.

An important observation about heavy industry in Refinery Row is that the area has very little or no room for expansion. Residential development within the City of Edmonton literally abuts the plants to the west and the Restricted Development Area and Sherwood Park are found to the immediate east. To the south of Refinery Row and spread throughout it are many light and medium industrial parks.

Heavy industry found throughout the remainder of the City of Edmonton includes the Genstar cement plant, the Domtar creosote plant, Gainers and Capital Packers meat packing plants, all along the Yellowhead Trail to the northeast; the IPSCO pipe manufacturing plant, STELCO Steel Finishing Works and Westeel-Rosco sheet metal plant in the southeast; and numerous smaller scale manufacturing plants throughout industrial areas in the City.

With the exception of three or four of the larger plants noted above, there is a very significant difference between the scale of heavy industries and their properties in the City of Edmonton (excluding Refinery Row) and those found in either Refinery Row or the Northeast Industrial Area. For example, the average size of heavy industrial properties in the City of Edmonton (and not in Refinery Row) is 17 hectares (42 acres). This compares with an average size of 70 hectares (173 acres) for heavy industrial properties in the Refinery Row area.

(b) Northeast Industrial Area and Remainder of Region

Map 4 illustrates the distribution of heavy industrial properties and districting in the City of Fort Saskatchewan, M.D. of Sturgeon and the Scotford area of the County of Strathcona. Table 3 lists the heavy industrial plants/owners in each of these municipalities.

In the City of Fort Saskatchewan are found two large scale and three small petrochemical plants, four gas plants, a pipe manufacturing plant and a bottled gases plant. The total area of these properties, all of which are concentrated in the northern part of the City, is 933 hectares (2,305 acres).

The County of Strathcona Scotford area accommodates three heavy industries, the Diamond Shamrock petrochemical plant and the recently opened Shell refinery and styrene plant. Together, the Shell and Diamond Shamrock properties total 797 hectares (1,969 acres) with the vast majority owned by Shell and vacant at this time.

The Imperial Oil fertilizer plant to the south of Redwater is the most significant heavy industry in the M.D. of Sturgeon. Also located in the municipal district is a Procor LPG storage facility, an Alberta Food Products canola processing plant

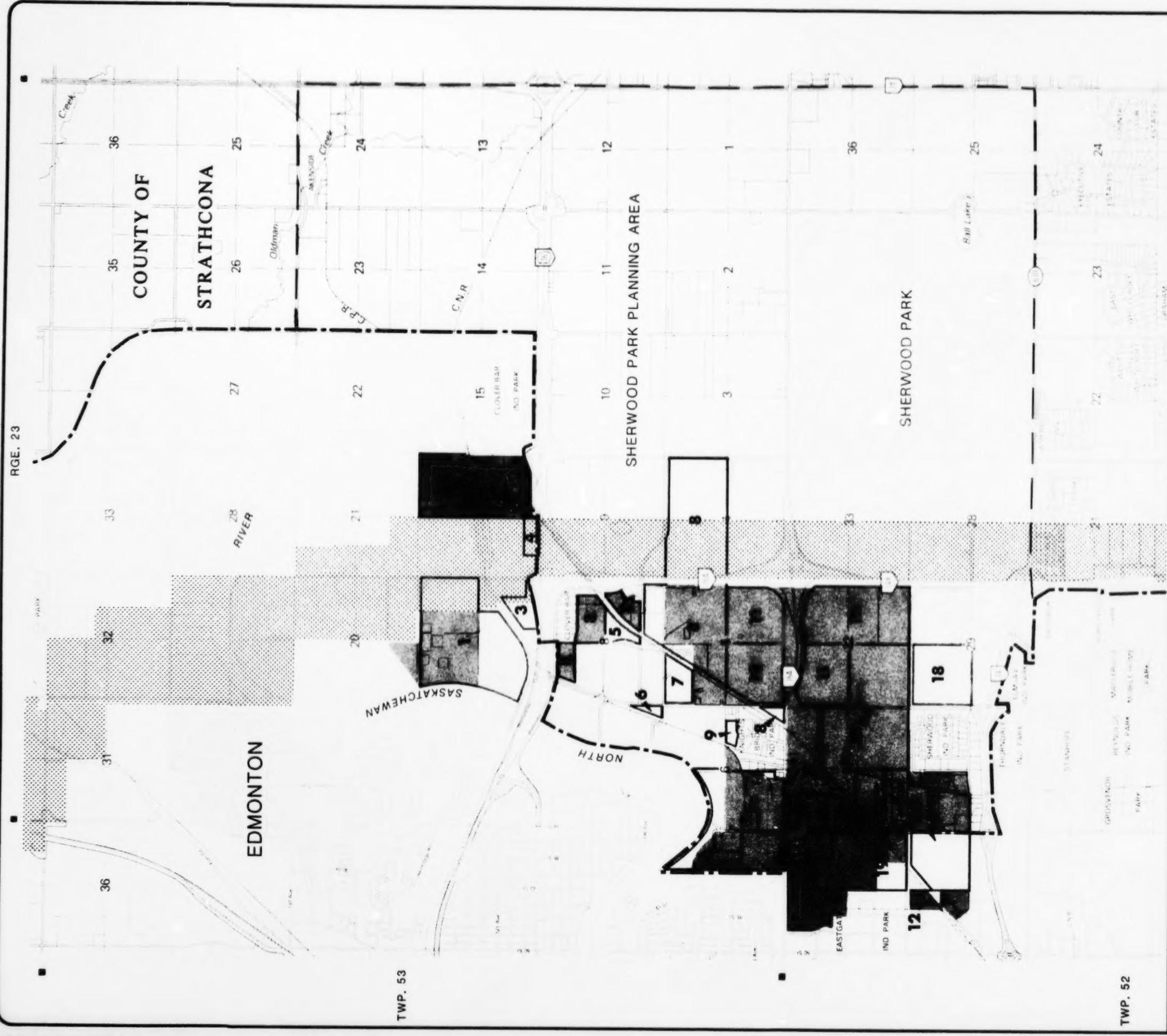
TABLE 2
HEAVY INDUSTRY BY MUNICIPALITY - REFINERY ROW AND REMAINDER OF CITY OF EDMONTON

MUNICIPALITY	FIRM/OWNER	TOTAL LAND AREA (hectares)	LEGAL DESCRIPTION	FACILITY DESCRIPTION
COUNTY OF STRATHCONA Sherwood Park	Esso Petroleum Canada	140	All 6-53-23	Refinery
	Gulf Canada Ltd.	271	N.E. 5-53-23	Refinery
			N.W. 5-53-23	Refinery
			S.E. 8-53-23	Refinery
			N.E. 8-53-23	-
			N.W. 8-53-23	-
			N.E. 4-53-23	-
			N.W. 4-53-23	R.D.A.
			S.W. 9-53-23	R.D.A.
	Texaco Canada Ltd.	222	N.W. 31-52-23	Refinery (not currently operating)
			N.E. 31-52-23	-
			S.E. 31-52-23	-
			S.W. 31-52-23	-
			S.W. 32-52-23	-
	Interprovincial Pipeline Limited	115	S.E. 5-53-23	Tank Farm
	Trans-Mountain Pipeline Co. Ltd.	57	N.W. 32-52-23	-
			S.W. 5-53-23	Tank Farm
CITY OF EDMONTON Refinery Row	Dome Petroleum Limited	20	N.W. 5-53-23	Tank Farm
	Gibson Petroleum Co. Limited	56	N.W. 5-53-23	Oil/Truck Storage
			N.E. 6-53-23	-
	Shell Canada Limited	172	S.E. 32-52-23	Tank Farm
			N.W. 29-52-23	-
			N.E. 32-52-23	-
	STELCO Inc.	88	S.W. 31-52-23	Steel Plant
			N.W. 30-52-23	-
	Alcan Smelters & Chemicals Ltd.	9	S.E. 8-53-23	Smelter
	Canada Packers Limited	4	N.W. 30-52-23	Meat Packing Plant
	Alchem Inc.	4	S.E. 7-53-23	Chemical Plant
	Union Carbide	3	S.W. 31-52-23	Chemical Plant
	Celanese Canada	180	Clover Bar	Petrochemical Plant
	Canada Cement LaFarge	54	Clover Bar	Cement Plant
	Fiberglas Canada Inc.	14	Clover Bar	Fiberglass Plant
	Truroc Gypsum	10	Clover Bar	Gypsum Plant
	C-I-L Inc.	42	Eastgate	Petrochemical Plant
	Esso Petroleum Canada	93	Eastgate	Oil Terminal/ Storage
	Building Products of Canada	12	Eastgate	Building Products Plant
	Northern Steel Inc.	7	Eastgate	Steel Plant
	Turbo Resources Ltd.	3	Eastgate	Refinery

TABLE 2, continued

MUNICIPALITY	FIRM/OWNER	TOTAL LAND AREA (hectares)	LEGAL DESCRIPTION	FACILITY DESCRIPTION
CITY OF EDMONTON Remainder of City (Samples only)	Genstar Cement Limited	81	Yellowhead West	Cement Plant
	Domtar Inc.	35	Yellowhead Trail (Hermitage)	Wood Preserving Plant/Storage
	Gainers Inc.	19	Northeast Industrial	Meat Packing Plant
	Canada Packers Inc.	10	Northeast Industrial	Meat Packing Plant
	Alberta Concrete Products	N/A	Stadium Road	Cement Plant
	Batonl Structures (1979) Ltd.	8	Mistatim	Precast Products Plant
	Borden Chemical	4	Mistatim	Chemical Products Plant
	Dome Petroleum Limited	N/A	Parsons	Ethane Plant
	Westeel-Rosco Ltd.	8	McIntyre	Sheet Metal Plant
	IPSCO Inc.	27	Davies	Pipe Manufac- turing Plant/ Storage
	STELCO Inc.	5	Davies	Steel Finishing Works
	Strathcona Steel Manufacturing Inc.	3	Papaschase	Steel Works
	Labatt's Alberta Brewery	6	Papaschase	Brewery
	Molson Alberta Brewery Limited	2	Hudsons Bay Reserve	Brewery

1 hectare = 2.471 acres



Heavy Industrial Land Designations and Ownership REFINERY ROW AREA

- | | | |
|--|---|---|
| <p>HEAVY INDUSTRIAL
(See Land Use Bylaws)</p> <p>OWNERSHIP (See List Following)</p> <p>RESTRICTED DEVELOPMENT AREA
(Utility Corridor)</p> | <p>1 Celanese Canada Inc.</p> <p>2 Canada Cement LaFarge Ltd.</p> <p>3 Fiberglas Canada Inc.</p> <p>4 Truroc Gypsum Products Ltd.</p> <p>5 Alcan Smelters & Chemicals Ltd.</p> <p>6 Alchem Inc.</p> <p>7 Dome Petroleum</p> <p>8 Gulf Canada Ltd.</p> <p>9 Esso Petroleum Canada</p> <p>10 Trans Mountain Pipeline Co. Ltd.</p> | <p>11 Interprovincial Pipeline Limited</p> <p>12 C-I-L Inc.</p> <p>13 Building Products of Canada Ltd.</p> <p>14 Northern Steel Inc.</p> <p>15 Turbo Resources Ltd.</p> <p>16 Union Carbide Can. Ltd.</p> <p>17 Texaco Canada Inc.</p> <p>18 Shell Canada Products Ltd.</p> <p>19 Procor Ltd.</p> <p>20 STELCO Inc.</p> |
|--|---|---|

Source: Strathcona Industrial Association and Edmonton Metropolitan Regional Planning Commission

TABLE 3
HEAVY INDUSTRY BY MUNICIPALITY - NORTHEAST INDUSTRIAL AREA

MUNICIPALITY	FIRM/OWNER	LAND AREA (hectares)	FACILITY/DESCRIPTION
CITY OF FORT SASKATCHEWAN	Dow Chemical Canada Inc.	468	Petrochemical Plant
	Sheritt Gordon Mines	201	Chemical Plant
	Thio-Pet Chemicals	7	Petrochemical Plant
	Union Carbide	3.5	Petrochemical Plant
	C-I-L Sulfur Products West	3.5	Chemical Plant
	Mansville Canada Inc.	8	Pipe Manufacturing
	Liquid Carbonic Canada Ltd.	2	Bottled Gases
	Chevron Canada Ltd.	120	Gas Plant
	Dome Petroleum Ltd.	117	Two Gas Plants
	Norcen Energy Resources Ltd.	2.4	Gas Plant

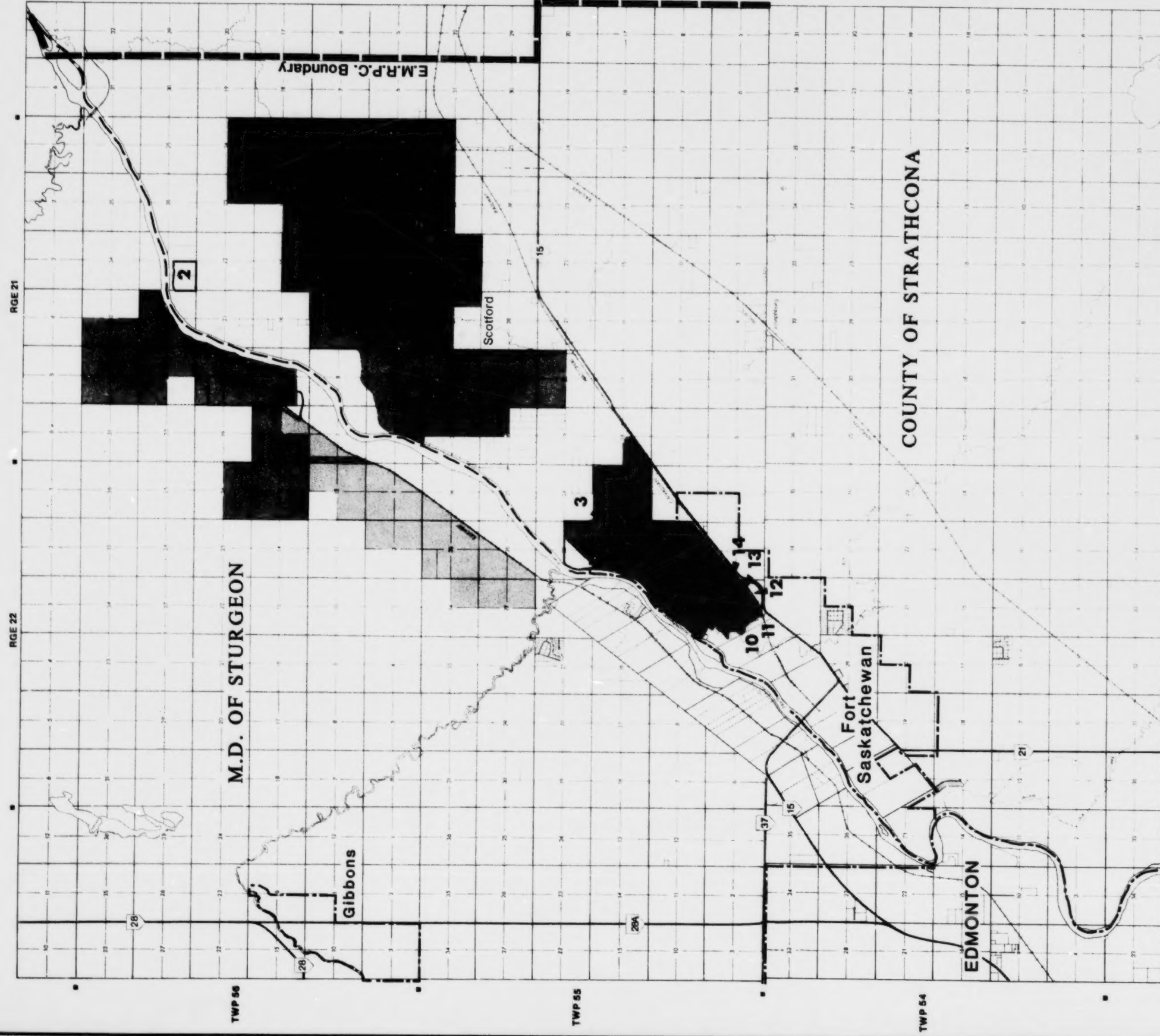
MUNICIPALITY	FIRM/OWNER	TOTAL LAND AREA (hectares)	LEGAL DESCRIPTION	FACILITY DESCRIPTION
COUNTY OF STRATHCONA Scottford Area	Shell Canada Limited	666	S.E. 32-55-21	Refinery
			S.W. 32-55-21	Refinery
			S.E. 31-55-21	Refinery
			N.E. 32-55-21	Petrochemical Plant
			S.E. 5-56-21	Petrochemical Plant
			N.E. 30-55-21	-
			N.E. 31-55-21	-
			N.W. 32-55-21	-
			S.W. 5-56-21	-
			S.E. 6-56-21	-
	Diamond Shamrock Alberta Gas Ltd.	131	S.E. 29-55-21	Petrochemical Plant
			N.E. 29-55-21	-
	Chevron Canada Ltd.	323	N.E. 9-56-21	-
			N.E. 10-56-21	-
			S.E. 10-56-21	-
			S.W. 10-56-21	-
			N.W. 10-56-21	-
	Texaco Exploration	193	S.E. 15-56-21	-
			S.W. 15-56-21	-
			S.W. 27-56-21	-
	Dow Chemical Canada Inc.	159	N.E. 13-55-22	-
			S.W. 13-55-22	-
			N.W. 13-55-22	-
	Dome Petroleum Limited	106	S.E. 23-55-22	-
			S.W. 23-55-22	-

continued...

TABLE 3, continued

MUNICIPALITY	FIRM/OWNER	TOTAL LAND AREA (hectares)	LEGAL DESCRIPTION	FACILITY DESCRIPTION
M.D. OF STURGEON	Esso Chemical Canada	371	S.E. 17-56-21 N1/2, S.W. 17-56-21 N.W. 17-56-21 Pt. N.E. 17-56-21 Pt. N1/2 S.E. 18-56-21 All 20-56-21 Pt. N.W. 21-56-21	Petrochemical Plant (Fertilizer)
	Alberta Food Products	15	R.L. 16, 18, 20 FSS 792-1398 Lot 2	Canola Processing
	Procor Ltd.	63	16-01-56-22X	LPG Storage
	Oakwood Petroleum Ltd.	N/A	10-19-54-26	Gas Plant
	Canada Northwest Energy Ltd.	N/A	13-12-54-25	Gas Plant
	Norcen Energy Resources Ltd.	3.7	S.E. 1/4 26-54-25	Gas Plant
	Northwestern Utilities Ltd.	0.9	N.E. 1/4 20-56-23	Gas Plant
	Amoco Canada Petroleum Company Ltd.	N/A	R.L. 9 SAS	Gas Plant

Source: City of Fort Saskatchewan, County of Strathcona, M.D. of Sturgeon.



Heavy Industrial Land Designations and Ownership

NORTHEAST INDUSTRIAL AREA

- | | | |
|--|---|---|
| <p>HEAVY INDUSTRIAL
(See Land Use Bylaws)</p> <p>POTENTIAL HEAVY INDUSTRIAL</p> <p>OWNERSHIP (See List Following)</p> | <p>1 Imperial Oil Ltd.</p> <p>2 Texaco Explorations Ltd.</p> <p>3 Chevron Canada</p> <p>4 Shell Canada Ltd.</p> <p>5 Diamond Shamrock</p> <p>6 Dome Petroleum Ltd.</p> <p>7 Dome/Cochin</p> | <p>8 Dow Chemical Canada Inc.</p> <p>9 Sheritt Gordon Mines Ltd.</p> <p>10 Canadian Liquid Carbonic Ltd.</p> <p>11 Inland Chemicals Ltd.</p> <p>12 Thio-Pet Chemicals Ltd.</p> <p>13 Manville Canada Inc.</p> <p>14 Union Carbide Canada Ltd.</p> |
|--|---|---|

Source: Fort Saskatchewan Regional Industrial Association and the Edmonton Metropolitan Regional Planning Commission

and 5 gas plants located throughout the municipality. Excluding the gas plants, a total of 449 hectares (1,109 acres) are under heavy industrial ownership in the M.D. of Sturgeon.

4. Existing Heavy Industry by Type and Size

Table 4 groups heavy industries according to type and provides a comparison of the relative size and significance of the different forms of heavy industry.

Petrochemical plants are the dominant form of heavy industry in the Edmonton Region. There are an estimated 1,699 hectares (4,198 acres) of land accommodating twelve existing petrochemical plants in the region, seven of which are rather substantive in size.

Oil refineries in the Region presently own 1,263 hectares (3,120 acres), including the Texaco refinery which recently ceased operations. Tank farms independent of the major oil companies own a further 364 hectares (899 acres).

Collectively, the total land owned and occupied by other forms of heavy industry is substantive, though most individual facilities are comparatively small. Exceptions to this, however, include the Stelco Steel Plant in Refinery Row, the Genstar and Canada Cement LaFarge cement plants in Yellowhead West and Clover Bar in the City of Edmonton, and the Dometar Creosote Plant in northeast Edmonton.

The median size of petrochemical properties is 315 hectares (778 acres) while the median size of other forms of heavy industry is as follows: oil refineries 270 hectares (667 acres); tank farms 96 hectares (237 acres); major cement plants 68 hectares (168 acres); major steel plants 46 hectares (114 acres); meat packing plants 17 hectares (42 acres); breweries 4 hectares (10 acres); and all other forms of heavy industry 33 hectares (82 acres).

Table 5 lists the total number and location of gas plants. A total of 17 gas plants are reported by the Energy Resources Conservation Board to be located in the Region, 10 of which are found in rural municipalities.

TABLE 4
EXISTING HEAVY INDUSTRY BY TYPE

DESCRIPTION	FIRM/OWNER	TOTAL HECTARES (developed and vacant)	LOCATION IN REGION		
			Refinery Row	Northeast Area	Other
Petrochemical Plants	Celanese Canada Inc.	180	City of Edmonton		
	C-I-L Inc.	42	City of Edmonton		
	Dome Petroleum Ltd.	N/A			City of Edmonton
	Borden Chemical	4			City of Edmonton
	Dow Chemical Canada Ltd.	627		Fort Saskatchewan	
	Sherritt Gordon Mines Ltd.	201		Co. of Strathcona	
	Thio-Pet Chemicals	7		Fort Saskatchewan	
	Union Carbide Canada Ltd.	3.5		Fort Saskatchewan	
	C-I-L Sulfur Products West	3.5		Fort Saskatchewan	
	Diamond Shamrock Alberta Gas Ltd.	131		Co. of Strathcona	
	Shell Canada Limited	129 ^a		Co. of Strathcona	
	Eso Chemical Canada	371		M.D. of Sturgeon	
Oil Refineries	Eso Petroleum Canada	233	Co. of Strathcona		
	Gulf Canada Limited	271	City of Edmonton		
	Texaco Canada	222	Co. of Strathcona		
	Turbo Resources Ltd. Shell Canada Limited	3 537 ^a	Co. of Strathcona (not operating) City of Edmonton		
Tank Farms	Interprovincial Pipeline Limited	115	Co. of Strathcona		
	Trans-Mountain Pipeline Co. Ltd.	57	Co. of Strathcona		
	Dome Petroleum Ltd.	20	Co. of Strathcona		
	Shell Canada Limited	172	Co. of Strathcona		
				Co. of Strathcona	
Cement Plants	Canada Cement LaFarge	54	City of Edmonton		
	Inland (Genstar) Cement	81			City of Edmonton
	Alberta Concrete Products	N/A			City of Edmonton
Steel Plants	Northern Steel Industries Limited	7	City of Edmonton		
	STELCO Finishing Works Ltd.	5			City of Edmonton
	Westeel-Rosco Ltd.	8			City of Edmonton
	IPSCO Inc.	27			City of Edmonton
	Strathcona Steel Manufacturing Inc.	3			City of Edmonton
	STELCO Inc.	88	Co. of Strathcona		
	Alcan Smelters and Chemicals Ltd.	9	Co. of Strathcona		
Meat Packing Plants	Gainers Inc.	19			City of Edmonton
	Canada Packers Inc.	10			City of Edmonton
	Canada Packers Inc.	4	Co. of Strathcona		

TABLE 4, continued

DESCRIPTION	FIRM/OWNER	TOTAL HECTARES (developed and vacant)	LOCATION IN REGION		
			Refinery Row	Northeast Area	Other
Brewery	Molson Alberta Breweries Limited	2			City of Edmonton
	Labatt's Alberta Brewery	6			City of Edmonton
Other Manufactur- ing	Fiberglas Canada Inc.	14	City of Edmonton		
	Truroc Gypsum	10	City of Edmonton		
	Building Products of Canada	12	City of Edmonton		
	Domtar Inc.	35			City of Edmonton
	Batonl Structures	8			City of Edmonton
	Gibson Petroleum Ltd.	56	Co. of Strathcona		
	Alchem Chemicals	4	Co. of Strathcona		
	Union Carbide Chemicals	3	Co. of Strathcona		
	Mansville Canada Inc.	8		Fort Saskatchewan	
	Liquid Carbonic Canada	2		Fort Saskatchewan	
	Alberta Food Products	15		M.D. of Sturgeon	
	Procor Ltd.	63		M.D. of Sturgeon	

1 hectare = 2.471 acres

⊙ Estimate.

TABLE 5
GAS PROCESSING PLANTS IN THE E.M.R.P.C. PLANNING REGION

PLANT	LOCATION	
Amoco Canada Petroleum Company Ltd.	14-36-53-26 W4M	(M.D. of Sturgeon)
Canada Northwest Energy Ltd.	13-12-54-25 W4M	(M.D. of Sturgeon)
Chevron Canada Resources Ltd.	S1/2 14-55-22 W4M	(City of Fort Saskatchewan)
Dome Petroleum Ltd.	N1/2 14-55-22 W4M	(City of Fort Saskatchewan)
Dome Petroleum Ltd.	S1/2 23-55-22 W4M	(City of Fort Saskatchewan)
Esso Resources Canada Ltd.	NE1/4 22-51-27 W4M	(County of Parkland)
Esso Resources Canada Ltd.	02-34-50-26 W4M	(Town of Devon)
Esso Resources Canada Ltd.	SE1/4 29-57-21 W4M	(Town of Redwater)
ICG Resources Ltd.	SW1/4 02-53-26 W4M	(County of Parkland)
Norcen Energy Resources Ltd.	SE1/4 03-55-22-W4M	(City of Fort Saskatchewan)
Norcen Energy Resources Ltd.	07-14-50-22 W4M	(County of Leduc)
Norcen Energy Resources Ltd.	SE1/4 26-54-25 W4M	(M.D. of Sturgeon)
Northwest Utilities Ltd.	NE1/4 20-56-23 W4M	(M.D. of Sturgeon)
Quasar Petroleum Ltd.	10-19-54-26 W4M	(M.D. of Sturgeon)
Redco Exploration Ltd.	06-34-51-23 W4M	(County of Leduc)
Star Oil and Gas Ltd.	08-25-57-23 W4M	(M.D. of Sturgeon)
Western Decalta Petroleum Ltd.	05-20-49-25 W4M	(County of Leduc)

Source: Energy Resources Conservation Board.

III Heavy Industry Issues

III. HEAVY INDUSTRY ISSUES

Sections I, and II of this report have provided an information basis from which the more pertinent land use issues associated with heavy industry can be discussed. Once again, it is emphasized that this report concerns itself with larger scale heavy industries such as petrochemical plants, oil refineries and other major fabricating industries. Small scale industries, which may also satisfy the definition for heavy industry, are not the focus of this report although comments contained herein may, also have applicability to such uses.

Discussion of issues in this section forms the basis for the suggested actions contained in Section IV of this report.

1. Land Use Issues

The impacts of heavy industry are not confined to plant sites or their immediate environs but can also have an effect on the extent and form of other development throughout the Region. As such, the impacts of heavy industry (and the reasons contributing to these impacts) form the issues to be addressed by the Edmonton Metropolitan Regional Plan and the planning efforts of relevant municipalities. These issues are described as follows:

(a) Amount of Land

Heavy industry accounts for large areas of land in the Edmonton Region. Section II documented that nearly 11,000 hectares (27,000 acres) of land are designated by municipalities in their Land Use By-laws for heavy industrial use. Existing heavy industry companies own approximately 4,000 hectares (9,900 acres) of land, 2,500 hectares (6,200 acres) of which are currently developed. These large areas of land involve a relatively limited number of heavy industries, with each plant, therefore, consuming a sizeable area of land.

The extent of land committed to heavy industrial use is most significant in the Northeast Industrial Area where 9,000 hectares (22,200 acres) of land is presently designated. Heavy industries in this area are large in scale and hold large tracts of vacant land for possible future expansion.

The total area of land committed to heavy industrial use in the older and more established Refinery Row area is less extensive but the total number of heavy industries is greater. Heavy industry in Refinery Row is more concentrated and, in many instances, without vacant land for possible future development.

While there are many similarities between heavy industrial land use in Refinery Row and the Northeast Industrial Area,

there are some important differences. Much of the designated heavy industrial land in Refinery Row is currently owned and occupied by long established heavy industries. Refinery Row, however, has very little room for expansion or infilling. New large scale heavy industries must therefore find alternative sites in the Northeast Industrial Area.

The Northeast Industrial Area, conversely, contains a vast amount of land designated for heavy industry with correspondingly large areas of vacant or agricultural land separating plant sites, leaving ample room for expansion both within areas presently designated and into adjacent areas. In addition, the properties accompanying plants in the Northeast Industrial Area, are on average, considerably larger than those in Refinery Row with much of this additional land currently vacant.

The majority of land designated for heavy industrial use in the Northeast Industrial Area is under agricultural use and is not owned by heavy industry. At the same time, the Municipal Land Use By-law regulations for these heavy industrial areas restricts any form of development which might limit the options for future heavy industrial growth. There are no guarantees that any of this land will be ultimately used for its intended purpose and therefore the County of Strathcona and M.D. of Sturgeon may have to re-evaluate these land commitments sometime in the future. Until such time, these large heavy industrial districts shall prevent any residential development and will ensure the continuation of agriculture as the predominant use.

(b) Site Requirements

The present pattern of heavy industrial land use is a function of several contributing factors, including the specific site requirements of the industry itself (others include the availability of properly districted land and provincial government guidance). These site requirements have remained largely unchanged since the first heavy industrial facility was constructed in the late 1940's.

The first site prerequisite for heavy industry is the availability of a large undeveloped area. During the 1940's, 1950's and early 1960's, heavy industry located to the east of Edmonton and the north of Fort Saskatchewan. However, the urban growth of these municipalities and the development of Sherwood Park has created geographical constraints to continued expansion of these areas. While existing heavy industry has been able to expand on their sites in Refinery Row and Fort Saskatchewan, more recent heavy industry has been guided to rural locations in the M.D. of Sturgeon and County of Strathcona where ample undeveloped land continues to be available.

A second important site requirement for heavy industry is the need to be downwind of urban areas, as most forms of heavy industry generate waste emissions. In the Edmonton Region, the prevailing winds are from the south and west. The strongest winds normally emanate from the northwest. These wind directions appear to support the location of heavy industry in the north and east parts of the Region.³

The trend toward heavy industrial development in the Northeast Industrial Area is most appropriate given the direction of prevailing winds. Heavy industrial development in Refinery Row, however, is now south and northwest of large residential areas in the City of Edmonton and Sherwood Park, respectively. While these industries originally were 2 miles east of the City of Edmonton and in a rural area, their present location, relative to these newer residential areas, can contribute to air quality conflicts. From an air quality point of view, the problem of urban encroachment in the Refinery Row area further supports the trend to development in the Northeast Industrial Area.

A third heavy industrial site requirement is accessibility to a major and reliable source of water. Heavy industry in Alberta uses the province's large rivers as the source of water for cooling and processing purposes. The Edmonton Region is fortunate to have the North Saskatchewan River, one of the province's major rivers, meandering through the region. The mean annual river discharge of the North Saskatchewan River, at the provincial boundary is 7,118 million cubic meters. This compares favourably to the Red Deer River, for example, with a mean annual discharge of 1,842 million cubic meters. (The Slave-Peace-Athabasca Rivers collectively form the largest river system in the province, however, other industry location factors favour smaller rivers further south in the province.)

The availability of a plentiful water supply has been a major supporting factor for the development of heavy industry in the Edmonton Region. All heavy industrial facilities which require large volumes of water are located within proximity to the North Saskatchewan River. The flow of the river from southwest to northeast also ensures that the water intake and discharge of heavy industry is downstream of most of the Region's urban areas.

The impact of heavy industry upon the North Saskatchewan River is undoubtedly significant. A major issue in this regard pertains to how much heavy industry the river can sustain, both in terms of volume requirements and secondly, in terms of an acceptable level of environmental degradation. While the

3. This information is sourced from Environment Canada. It is noted that prevailing winds may vary throughout the region. For example, at the Edmonton Municipal Airport, prevailing winds are generally from the south. At CFB Namao, prevailing winds are generally from the west.

more recent heavy industrial developments have had to account for the environmental impact of their operations as part of the Industrial Development Permit process (as issued by the Energy Resources Conservation Board), the older heavy industries were not required to provide this type of information at the time of their development. The cumulative effect of all heavy industries upon the North Saskatchewan River is an important issue which requires further evaluation and careful monitoring.⁴

The need for some heavy industries to be in proximity to a large water supply source has resulted in several plants locating adjacent to or partially within the North Saskatchewan river valley itself. The recent trend of heavy industrial growth in the Northeast Industrial Area, however, has resulted in a movement away from the river valley. For example, it is observed that the large heavy industrial district in the County of Strathcona is setback from the river valley. New heavy industrial plants in the Scotford area are accordingly separated from the river valley by at least 1/2 mile.

The maintenance of an appropriate distance between heavy industry and the North Saskatchewan River valley is an important issue for all relevant municipalities to address in their respective planning efforts.

Another equally important site requirement of large scale heavy industry is the need for essential infrastructure to be in place or readily available. The costs associated with placing a new heavy industry in an isolated or "greenfield" site are prohibitive. Large cost savings, both in terms of plant construction and operation, can be realized if the prospective heavy industry can tap into existing infrastructure. These cost savings, in large part, determine the economic viability of a plant and a region relative to other potential locations.

Topping the list of infrastructure requirements are related heavy and service industries already in place. The products of one petrochemical plant frequently are the derivatives required for manufacturing in another plant which may in turn produce goods essential for yet another plant, and so on.

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4. Alberta Environment does maintain an ongoing program to periodically monitor the effluents of heavy industry and secondly, to monitor the general water quality in the North Saskatchewan River at a series of locations on a regular basis. In addition, Alberta Environment is presently preparing a North Saskatchewan River Basin Plan (and a series of background studies) which may shed further insight on the impact of heavy industry upon the river and provide some guidance for future development. Nonetheless, more detailed research on this issue may be warranted.

Such a network of interdependencies has formed a world scale petrochemical complex yielding improved economies of scale with the addition of each new plant.

The Refinery Row and Northeast Industrial Area possess a well-developed system of highways, railways, pipelines and power sources which were put in place in response to the needs of industry. While the Refinery Row area has a more sophisticated and developed physical infrastructure, it has serious geographical impediments for continued expansion.

Conversely, the Northeast Industrial Area has few spatial limitations for continued heavy industrial growth. However, the spread out pattern of development, in combination with a less developed infrastructure system, contributes to higher construction and operational costs.

The installation and utility of supportive infrastructure for heavy industry has a substantial impact upon the pattern of land uses in, around and between the industrial areas in which they serve. While pipelines, highways, railways and powerlines perform an important linking and supportive function, they also form linear barriers that influence, if not determine, the direction and form of future urban growth. Similarly in rural areas, such infrastructure can have a profound impact upon the viability of the agricultural community. It is therefore important that the location and scale of the noted infrastructure develop in a manner sensitive to the function of nearby land uses and in a manner which does not unnecessarily preclude its options for future growth.

2. Compatibility

Discussion in the "Site Requirements" section of this report identified the need for large scale heavy industry to locate in rural areas. The observation at that point was that only rural areas could provide the large amount of land required for plants and their sites. However, rural areas afford another important locational advantage for heavy industry in that they primarily consist of agriculture and other land uses generally compatible with heavy industry.

The compatibility of heavy industry with other forms of land use is one of the more important issues associated with this form of development. The relevance of this issue is predicated upon the impact or potential impact of heavy industry upon adjacent areas. A common characteristic of heavy industry is the creation of nuisance factors, including safety hazards, which extend beyond the boundaries of the plant site. These nuisance factors have a deleterious effect upon adjacent land uses and therefore limit acceptable forms of development in surrounding areas. Examples of compatible land uses might include medium and light industry, and agriculture.

Examples of land uses more sensitive to the impacts of heavy industry and which require proper separation include residential and institutional development.

Heavy industrial companies have long recognized the need for uses adjacent to plant sites to be compatible. As such, these companies have attempted to influence local governments to plan for uses in surrounding areas which would not limit their options for expansion.

Another method employed by heavy industry to control the use of adjacent land has been to buy larger tracts of land than are required for plant operations. This land not only contains space for future expansion but also provides for some separation between the plant and neighbouring properties. This rationale has contributed to the very large land holdings held by heavy industry companies in the Northeast Industrial Area.

The issue of compatibility is also applicable to the relationship between supportive linear infrastructure, such as pipelines, highways and railways, and land uses adjacent to these corridors. It is important that appropriate standards be employed by municipalities to ensure that such facilities are compatible with adjacent uses and visa-versa.

The impact of linear facilities is not merely aesthetic but also one of safety and function. Given the volumes and types of goods transported, it is imperative that the potential impact of these corridors be adequately addressed by municipalities in their statutory plans and by-laws.

3. Encroachment

Encroachment can be generally described as the development of new residential land uses (or any other use incompatible with heavy industry) in the direction of, and in proximity to, existing heavy industry. Encroachment leads to a progressively eroded separation distance between these incompatible uses which, in turn, may limit the option for future growth of the heavy industry or may result in a residential area that is susceptible to the deleterious effects of the heavy industry.

The issue of encroachment is particularly relevant to the Refinery Row Area. As indicated earlier, the first heavy industries in Refinery Row were in a rural area, 2 miles east of the City of Edmonton. Since that time, however, the City of Edmonton has expanded immediately up to the west boundary of Refinery Row and the Hamlet of Sherwood Park has developed immediately to the east of Refinery Row. The resulting configuration of land uses has left little if any room for the expansion of Refinery Row and may subject some residential areas to a greater degree of heavy industrial impacts than would otherwise be desirable.

In the Northeast Industrial Area, and with the possible exception of Fort Saskatchewan, the relationship of heavy industry and residential development is at a stage similar to that in Refinery Row during the late 1940's and the 1950's. All of the newer heavy industries in the Northeast Industrial Area are in rural areas surrounded by agricultural land. Within the City of Fort Saskatchewan, residential growth is being encouraged to the south and east, away from heavy industry while heavy industrial growth is being directed to the north, away from residential uses.

Both the M.D. of Sturgeon and the County of Strathcona have the opportunity to ensure that encroachment does not occur in the Northeast Industrial Area and indeed have already initiated planning measures to achieve that end (e.g. the establishment and protection of very large districts for future heavy industrial use which also restrict residential development).

4. Transition Areas

(a) Definition

The most direct means to adequately separate these incompatible land uses is to identify a transition area or buffer, around the heavy industry. A definition of such an area might be as follows:

The area between an emission source(s) and nearby sensitive land uses, where land use controls are used to minimize any significant adverse effects. It can be of variable size, shape and composition to produce the desired results and apply to all or part of an Influence Area.⁵

A transitional area provides for development located between heavy industry and incompatible land uses to be transitional from heavy or noxious to light to non-industrial uses.

The objective of a transitional area should be to reduce the exposure of people to the undesirable and/or hazardous impacts of heavy industrial activity. The implementation of a transition area cannot ensure that all deleterious impacts will be entirely separated from population concentrations but rather that such exposure will be mitigated to more acceptable levels.

5. Ontario Ministry of the Environment, Land Use Compatibility Policy Form, January 27, 1982.

(b) Implementation

The implementation of a transition area generally requires the consideration of the following factors: the distance (size) and shape of the area; the point from which the measurement is to occur; the permitted uses in the area; and the means by which such an area is to be administered. A transition area may involve the districting of land in the Land Use By-law or the designation of land in the General Municipal Plan and might be addressed in regulations, policies or background material adopted by resolution or by-law by the municipality. Given the implementation options available, the transition area concept should properly be viewed as a flexible planning tool which can be tailored to suit each municipality.

(c) Examples

At present there are no examples of transition areas in effect around heavy industrial areas in the Edmonton Region. However, examples are found in eastern Canada and abroad. One such example is the Haldimand-Norfolk, Ontario, Official Plan, adopted by Regional Council, August 1978, which established an "Industrial Influence Area" of 3 km around the exterior boundaries of several heavy industries.⁶

Within the Edmonton Region, the Strathcona Industrial Association, (an organization representing heavy industries in Refinery Row) has recommended a minimum 3 km separation between existing heavy industry and incompatible land uses.⁷ Pursuant to the Strathcona Industrial Association representation to the Local Authorities Board in 1980, the LAB made the following recommendation:

That there not be permitted any residential development closer than 3 km to any existing heavy industry or areas designated for heavy industry, except where this encroachment now exists. That areas which now are designated for residential purposes which are within this restricted zone but upon which physical

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6. Strathcona Industrial Association, Local Authorities Board Submission, Edmonton Annexation Hearings, Edmonton, 1980.
 7. Strathcona Industrial Association, Submission to Edmonton Metropolitan Regional Planning Commission, March 1983.

development has not yet taken place, shall be precluded from having the residential development take place.⁸

The draft Edmonton Regional Plan, March 1979, which contained policy on the compatibility of industrial and adjacent land uses, stated the following:

Where feasible and practical, a minimum of 1.6 km (1.0 mile) separation of the building sites of noxious industry and areas of ecological importance or residential development will be required.⁹

The Proposed Edmonton Metropolitan Regional Plan, December 1982, contained the following heavy industrial land use policies.¹⁰

1.6.13 The Commission recommends that a minimum 3.0 km separation should be maintained between future heavy industrial land areas ... and major population concentrations.

1.6.14 A minimum 1.5 km buffer shall be maintained to separate heavy industrial areas from incompatible land uses such as: residential developments; schools, hospitals; and other institutions for human habitation.

The noted examples are provided for the information of municipalities and serve as useful examples to assist in establishing "transition areas" in the Region. As previously indicated, another integral component of this assessment process is to determine from where the measurement is to occur - the heavy industrial plant, the heavy industrial property boundary, the edge of the heavy industrial districting or from some other point of reference.

(d) Considerations for the Edmonton Region

In the Edmonton Region, the two heavy industrial areas (Refinery Row and the Northeast Industrial Area) are substantially different in their geographical composition and

8. City of Edmonton Annexation Application, "Board Order No. 14000, Report and Recommendations, Alberta Local Authorities Board, November 1980.

9. Edmonton Regional Planning Commission, Draft Edmonton Regional Plan, Volume 2, March 1979, page 3-20.

10. Edmonton Metropolitan Regional Planning Commission, Proposed Edmonton Metropolitan Regional Plan, December 1982, page 26.

therefore might require different measures to achieve adequate separation from incompatible uses. For example, the Refinery Row Area is relatively compact which would lend itself to a transition area around the area as a whole. Conversely, heavy industry in the Northeast Industrial Area is clustered in three different locations, each in a separate municipality.

In the Northeast Industrial Area, it would be more appropriate to establish distinct transition areas around each heavy industrial cluster. In order to achieve adequate separations in either area, joint planning between neighbouring municipalities might be required.

A most important consideration for municipalities establishing transition areas around heavy industry is the types of uses to be permitted in these areas. It is neither desirable or logical to effectively sterilize all forms of development in transition areas. Rather, there are numerous land uses which can be properly encouraged to locate in transition areas. These include light and medium industry, transportation facilities (excluding airports), commercial uses, storage areas, intensive and other forms of agriculture. With the exception of residential and institutional uses, most land uses can be accommodated in transition areas.

A concluding note here is directed to municipalities which accommodate gas plants. Although gas plants generally occupy small parcels of land and have less extensive processing facilities than petrochemical and other heavy industries, they do nonetheless impose deleterious effects upon adjacent areas. Municipalities with gas plants should be cognizant of the extent of such effects and establish planning measures to effectively separate gas plants and incompatible uses. (In this regard, the Energy Resources Conservation Board should be consulted).

5. Other Impacts

Though the focus of this report is to address the land use impacts of heavy industrial development in the Edmonton Region, it is also recognized that heavy industry has other important impacts beyond plant sites and adjacent areas. While it is not the intent here to elaborate upon these other impacts, it is useful to identify the more significant impacts and perhaps set the stage for further investigation.

(a) Land Use Multipliers

Collectively, the land use requirements of the many supportive industries directly and/or indirectly associated with heavy industry in the Region are substantive. In addition to supportive infrastructure and its land use implications, heavy

industrial plants also rely upon a network of supply and services industries in order to maintain plants and their productivity. These spinoff industries also require supply and service industries and all these interdependent industries require space in industrial or commercial areas.

Preliminary research suggests that the location of support industries to heavy industry is neither concentrated in the Refinery Row or Northeast Industrial Areas but rather is distributed throughout the Inner Metropolitan Area and a number of other municipalities. The demand for land to accommodate support industries to heavy industry is therefore an issue of regional significance.

Further research on this topic could provide more information on the nature of the support industry and would identify those industrial areas which best satisfy those needs. Such research would also be of benefit for many municipalities in the Region in their efforts to provide for and attract appropriate industrial development to their jurisdictions.

(b) Economic Impact

The economic impact of heavy industrial development in the Edmonton Region has been and continues to be very significant. Heavy industry contributes millions of tax dollars, directly employs thousands of workers and is a major economic stimulus for a wide variety of other industries and services. For example, since 1975 growth in the Region's petrochemical sector has generated nearly \$2 billion in capital cost construction employing thousands of construction and service industry workers and directly creating over 900 permanent positions.

The economic impacts of heavy industry are, of course, directly related to, and the underlying impetus for, the land use multipliers noted above. Again, investigation of the economic impact of heavy industry is a major study in itself which would assist municipalities in their efforts to provide for and attract industrial development.

(c) Environmental Impact

The environmental impacts of heavy industry constitute one of its most significant deleterious effects. However, with the proper understanding and preventative measures, these effects can be effectively managed and minimized. As was indicated earlier, the cumulative environmental effects of heavy industry in the Region are not well documented (although Alberta Environment does monitor heavy industry effluent and emissions). It is recognized, however, that heavy industry does utilize and discharge large volumes of water from the North

Saskatchewan River, that it uses sub-surface salt domes and other caverns for product storage and generates plant emissions that primarily effect the east and northeast parts of the Region. It is imperative, therefore, that municipalities be aware of the planning implications of these and other environmental effects in order that the safety and comfort of the public can be maintained and that sensitive and valuable areas of the Region are not unduly degraded.

The North Saskatchewan River Basin Plan, currently being prepared by Alberta Environment, may provide municipalities in the Region valuable guidance on planning for heavy industrial and nearby uses in proximity to the North Saskatchewan River. However, this study will primarily address the impacts of various demands upon the water levels and water quality of the North Saskatchewan River. Therefore more investigation may be warranted into the overall environmental impacts.

In addition, further research would also be appropriate on the air quality impact of heavy industry in the Region. Both Alberta Environment and the Strathcona Industrial Association maintain a data base of air quality information which might assist municipalities to identify "transition areas" around heavy industry.

(d) Transportation Impact

The construction and operation of heavy industrial plants generates considerable movement of employees, trucks, raw resources and finished products to and from plant sites. In order for heavy industry to operate economically and efficiently, the Region's highway and railway infrastructure has had to adequately respond to the needs of heavy industry.

Conversely, the impacts of heavy industry upon the transportation system and adjacent land uses must not unduly impact the safety of the Region's population. In this regard, the movement of hazardous goods is an issue which may warrant further analysis and a greater understanding.

Presently, the Edmonton Region has the largest movement of hazardous goods in the province. Most hazardous goods are transported by rail (i.e. 82% of petrochemicals in Alberta are shipped by rail) though large volumes are also transported by truck. Highway 2 between Edmonton and Leduc has the largest volume of hazardous goods movements in the province. Other highways with large volumes of hazardous goods movements include Highways 28 and 63 north and Highway 16 east and west. The future development of the Swan Hills hazardous waste plant will further increase hazardous goods movements within the Region.

The implications of hazardous waste movement should be understood by all municipalities, such that population concentrations and other sensitive land uses can be adequately separated from the movement of these goods.

IV Conclusions And Recommendations

IV. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study has been to provide a comprehensive information base of heavy industrial land use in the E.M.R.P.C. Planning Region. In doing so, this report contains an inventory of the location, extent and type of heavy industry in the Region and second, identifies the more pertinent land use issues associated with heavy industrial development.

This section summarizes the important issues identified in the report. Accompanying the issues is a set of suggested actions or recommendations for the consideration of municipalities in addressing the issues and in planning for future heavy industry and nearby development.

The issues and suggested actions are as follows:

ISSUE 1: Definition of Heavy Industry

The term "heavy industry" does not refer to a single type of industry but rather a variety of industrial activities with certain common characteristics. As such, heavy industry is difficult to define and is therefore defined differently in most jurisdictions.

ACTION: That the Commission develop a common definition of heavy industry for the consideration of municipalities in their General Municipal Plans and Land Use By-laws.

ISSUE 2: Gas Plants as Heavy Industry

Gas plants possess many of the characteristics associated with heavy industry. However, gas plants are not identified as a form of heavy industry in many General Municipal Plans and Land Use By-laws.

ACTION: That all municipalities consider the heavy industrial characteristics of gas plants in the context of their General Municipal Plans and Land Use By-laws.

ISSUE 3: Amounts of Land Zoned for Heavy Industry

Assuming the existing vacant heavy industrial land is located in areas suitable to potential new industry, and assuming the growth of heavy industry is consistent with past trends, the existing supply of heavy industrial land in the Region should be adequate to meet the demand for a long time.

ACTION: Given the amount of vacant heavy industrial land in the Region, municipalities should, as part of their statutory plan reviews, re-evaluate periodically their heavy industrial land commitments, and the assumptions justifying these commitments, to ensure these commitments are appropriate and that the assumptions are still valid.

ISSUE 4: Compatibility

A common characteristic of heavy industry are the nuisance factors which often extend beyond the boundaries of the plant site, thereby having a deleterious effect upon adjacent land uses.

ACTION: Municipalities should, in their General Municipal Plans and Land Use Bylaws, plan for new heavy industry to be adequately separated from incompatible uses such as residential and institutional uses.

ISSUE 5: Encroachment

Encroachment (the development of new residential and institutional land uses in the direction of, and in proximity to, heavy industry) limits the options for future growth of heavy industry, such as in Refinery Row. Second, encroachment may result in residential and institutional uses that are subject to a greater degree of heavy industrial impacts than would otherwise be desirable.

ACTION: That municipalities require that further encroachment by incompatible uses does not occur in the Refinery Row area and secondly, that municipalities, in their General Municipal Plans and Land Use Bylaws, implement planning measures to prevent encroachment in the Northeast Industrial Area.

ISSUE 6: Transition Areas

The most effective means to adequately and safely separate heavy industry and incompatible land uses, is to identify a transition area around the heavy industry. A transition area would provide for development located between heavy industry and incompatible land uses to be transitional from heavy to medium to light to non-industrial uses. In rural areas containing better agricultural land, the most appropriate transitional use would be agriculture.

ACTION 1: (a) That the City of Edmonton and the County of Strathcona define respectively a transition area around Refinery Row as a whole.

(b) That the Town of Fort Saskatchewan, County of Strathcona and M.D. of Sturgeon respectively define transition areas around the clusters of heavy industry in their municipalities in the Northeast Industrial Area.

(c) That all municipalities define adequate transition areas around gas plants.

ACTION 2: That, in the interim, relevant municipalities, in their General Municipal Plans and Land Use By-laws, consider:

- (a) a minimum 3.0 km (1.9 mi.) separation between heavy industrial areas and major population concentrations; and
- (b) a minimum 1.5 km (.95 mi.) separation between heavy industrial areas and incompatible land uses.

note: These are suggested separation distances only. Appropriate distances may vary according to the type of heavy industry, the direction of predominant winds, topography and other relevant considerations.

ACTION 3: That municipalities, in their General Municipal Plans and Land Use By-laws:

- (a) plan for residential development in a manner which will not encroach within the heavy industrial transition area;
- (b) not permit heavy industrial expansion within the heavy industrial transition area; and
- (c) provide for the maintenance of a satisfactory distance between heavy industry, the North Saskatchewan River valley and other environmentally sensitive areas.

ISSUE 7: Economic, Environmental and Transportation Impacts

Heavy industry has a profound impact upon the Edmonton Region. However, many of these impacts are not adequately understood. Further investigation on the economic, environmental and transportation impacts of heavy industry would provide valuable information for municipalities in the Region.

ACTION: That Regional studies be undertaken on the following:

- (a) Economic Impact of Heavy Industry - An analysis of the economic importance of heavy industry, including linkages to service and supply industries, their locational and land use requirements. Such a study would assist municipalities to target and attract industrial development to their jurisdictions.

- (b) Environmental Impact of Heavy Industry - An assessment of the cumulative environmental effect of all heavy industries upon the North Saskatchewan River and the Region in general. Such a study would provide many municipalities with information which would assist them in planning for recreational and other pursuits in the North Saskatchewan River valley, in determining environmentally acceptable criteria for future heavy industrial development, in delineating the "influence areas" of heavy industry, etc.
- (c) Transportation Impact of Heavy Industry - An investigation of the movement of hazardous goods in the Edmonton Region and an assessment of the planning implications of such movement. The findings of such a study would assist municipalities in determining population concentrations and other sensitive land uses to be adequately separated from the movement of these goods.

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Appendices

APPENDIX I - DEFINITION OF HEAVY INDUSTRY

The Introduction to this report stated "heavy industry" does not refer to a single type of industry but rather a variety of industrial activities with certain characteristics in common.

The diversity of characteristics associated with heavy industry is further illustrated in Table A-1. One of the more variable characteristics of heavy industry is the scale of manufacturing or processing activities occurring. For instance, heavy industrial plants can range from small but noxious cement plants occupying to 2 hectares, to oil refineries or petrochemical plants occupying several hundred hectares. Notwithstanding this diversity, municipalities generally establish heavy industrial districts to accommodate industrial activities with unique land use and resource requirements that generate a high degree of nuisance factors extending beyond the boundaries of the site.

TABLE A-1
HEAVY INDUSTRY AS DEFINED IN LAND USE BYLAWS IN THE E.M.R.P.C. REGION

CITY OF EDMONTON LAND USE BYLAW, SECTION 430.2 (Permitted Uses)	M.D. OF STURGEON LAND USE BYLAW, SECTION 31 (Permitted Uses)	COUNTY OF STRATHCONA LAND USE BYLAW, (Discretionary Uses)	CITY OF FORT SASKATCHEWAN LAND USE BYLAW, SECTION 55 (Permitted Uses)
General Industrial Uses which are characterized by one or more of the following features: 1. Large land requirements for outdoor service, assembly, processing, or fabricating operations or storage. 2. The creation of nuisance factors which extend beyond the boundaries of the site and which, in the opinion of the Development Officer, may have a deleterious effect on other Districts due to noise, odour or the emission of air contaminants. 3. The use of materials or processing operations which require separation from other developments due to fire and explosion hazards.	1. Manufacturing. 2. Industrial warehousing and storage. 3. Sewage treatment and disposal plants. 4. Sanitary and modified sanitary landfill sites. 5. Plants for the manufacture of petroleum products, pulp and paper products, stone, clay and glass products, cement and lime products, fertilizers, animal by-products. 6. Plants which will be engaged in the primary metal industry, metal processing, the processing of natural gas or its derivatives, the manufacture of asphalt, gravel crushing. 7. Incinerators, including those for municipal or industrial use. 8. Any use which, in the opinion of the Development Officer, is of a similar nature and will not be incompatible with adjacent land uses.	1. Incinerators, including those for municipal or industrial use. 2. Plants for the manufacture of petroleum products, chemical and allied products, pulp and paper products, stone, clay and glass products, cement and lime products, fertilizers, animal by-products. 3. Plants which will be engaged in the primary metal industry, metal processing, the processing of wood or wood products, the processing of natural gas or its derivatives, the manufacture of asphalt, gravel crushing. 4. Public utility uses and installations. 5. Sanitary and modified sanitary landfill sites. 6. Sewage treatment and disposal plants. 7. Such commercial, recreation and principal uses as are unlikely to have restrictive effects upon the development of the industrial area and are compatible with the industrial uses. 8. Such accessory uses as are essential to the industrial uses. 9. Any other use which, in the opinion of the Commission, is of a similar nature.	1. The processing of natural resources. 2. Land requirements for outdoor service, assembly processing of fabricating operations or storage. 3. The creation of nuisance factors which extend beyond the boundaries of the site and which, in the opinion of the Development Officer, may have an adverse effect on uses within this district (but not outside the district) due to noise, vibration, odour or the emission of air contaminant.

APPENDIX II - HEAVY INDUSTRY AND THE REGIONAL PLAN

The Edmonton Metropolitan Regional Plan identifies heavy industry as a unique form of land use requiring planning measures to address its particular set of requirements and associated impacts. The Regional Plan subsequently contains several policies which have a bearing upon heavy industrial development in the region and its relationship with adjacent land uses. These policies address the more critical of the land use issues discussed earlier in this report.

Regional Plan policies directly relevant to heavy industrial land use include policies 4.3(i), 4.4, 4.5, 4.9(d) and 4.10.

Regional Plan policies which have a bearing on heavy industrial land use include policies 4.3(a), (b), (c), (d), (f), 5.2, (6.1(a), 7.6, 9.2(d), 9.9(d), 11.1 and 11.2.

The following briefly summarizes the intent of directly relevant Regional Plan policies.

Policy 4.3 Municipalities should, in their General Municipal Plans and Land Use By-laws, plan for industrial land use which:

- (i) provides for development located between heavy industry and incompatible land uses to be transitional from heavy or noxious to light to non-industrial uses ...*

Heavy industry is the most noxious and incompatible of industrial land uses. Uses immediately adjacent to heavy industry should only include those with a higher degree of compatibility (medium industry, extensive agricultural uses, open space, etc.). Less compatible uses should be separated from heavy industry in a manner and at a distance representative of their sensitivity to the impacts of heavy industry.

Policy 4.4 Municipalities, in their General Municipal Plans and Land Use By-laws, should identify heavy industry as a distinct form of industrial land use and should:

- (a) identify and protect areas for petrochemical and other heavy industrial development; and*
- (b) provide for the clustering of heavy industry.*

Heavy industry is an important component of the Region's economy with strong potential for continued growth. The unique land use, resource, and infrastructure needs of heavy industry limit the locational choices available for its future growth in the Region.

Municipalities with such industries or having the potential to attract such industries, should ensure that appropriately located and sufficiently large areas are set aside for future heavy industrial growth. Provisions for such growth should encourage clustering as a means of minimizing land use compatibility problems and achieving economies of scale for both industry and the municipality providing infrastructure and servicing.

Policy 4.5 Municipalities shall, in their General Municipal Plans and Land Use By-laws, establish separation distances between heavy industry and incompatible land uses. This should be done in consideration of the following:

- (a) the need to maintain a safe distance from major population concentrations;*
- (b) the need to allow for expansion of heavy industry; and*
- (c) the direction of prevailing winds.*

The unique land use needs and associated impacts of heavy industry warrant planning measures that provide for adequate separation or buffer distances between it and incompatible land uses. Among the more important considerations is the separation of heavy industry from large residential areas, not only as a safety precaution but also in order to enable future heavy industrial expansion.

A key factor in determining buffer distances is the direction of prevailing winds as they relate to plant emissions. Heavy industrial land use upwind of residential areas may require greater separation distances than that which is downwind of residential areas. Past submissions from the Strathcona Industrial Association have recommended a minimum separation distance of 3 kilometers. The proposed 1982 Edmonton Metropolitan Regional Plan recommended a 3 kilometer separation between future heavy industrial areas and major population concentrations as well as a 1.5 kilometer buffer between existing heavy industrial areas and all forms of incompatible uses [see also Policy 4.3(i)].

Policy 4.9 Rural municipalities, in their General Municipal Plans and Land Use By-laws, should make provision for rural industrial land uses which include:

- (d) industries which, by reason of emissions offensive or hazardous to human health, safety and well-being, cannot reasonably be expected to co-exist compatibly with other essential elements of an urban environment (See Policies 4.4 and 4.5).*

In 1981, the A.P.B. "Rural Industrial Land Use Guidelines" introduced policy concepts to be incorporated into all regional plan industrial policy sets. The A.P.B. guidelines identified the types of industry appropriate for rural municipalities and some of the more important locational factors which need also be considered. The Regional Plan has followed this A.P.B. direction (Policy 4.9 is nearly a direct quote from the A.P.B. guidelines).

Policy 4.9(d) generally describes the characteristics typically associated with heavy industry. Heavy industry is therefore considered to be a "rural industrial land use" and, as such, is encouraged to locate in rural areas.

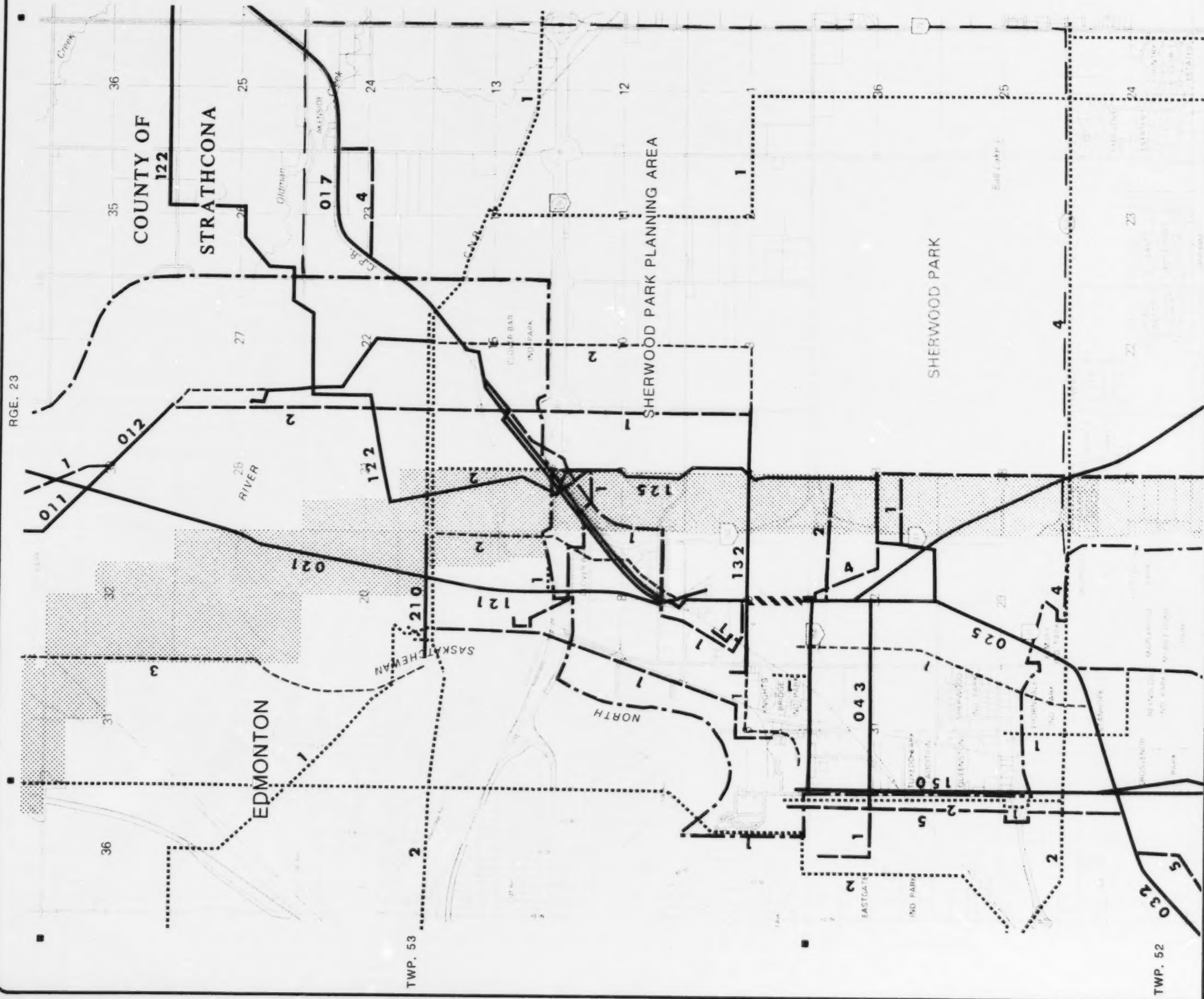
Policy 4.10 Rural municipalities, in their General Municipal Plans and Land Use By-laws, should cluster rural industrial land uses:

- (a) on poorer quality soils where there are adequate services; and*
- (b) outside Fringe Areas.*

Policy 4.10 states rural municipalities should plan for rural industrial land uses, including heavy industry, to cluster. Traditionally, Regional Plan policy has advocated the concentrated pattern of rural industrial land uses as opposed to the indiscriminate dispersal of such uses. The clustering of heavy industrial land uses may prevent the fragmentation of farmland and facilitate the economical provision of services.

Clustering of heavy industrial land uses on poorer quality soils contributes to the preservation of better agricultural land. However, such clustering should only occur where adequate services exist or can be provided.

Heavy industrial land uses are typically incompatible with an urban environment. Given the proximity of Fringe Areas to urban municipalities and their potential for future urban development, rural industrial land uses should locate outside Fringe Areas unless they can be properly buffered within a rural metropolitan industrial area, so as to avoid problems of compatibility.



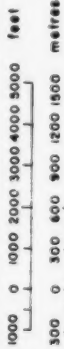
Major Pipelines REFINERY ROW AREA

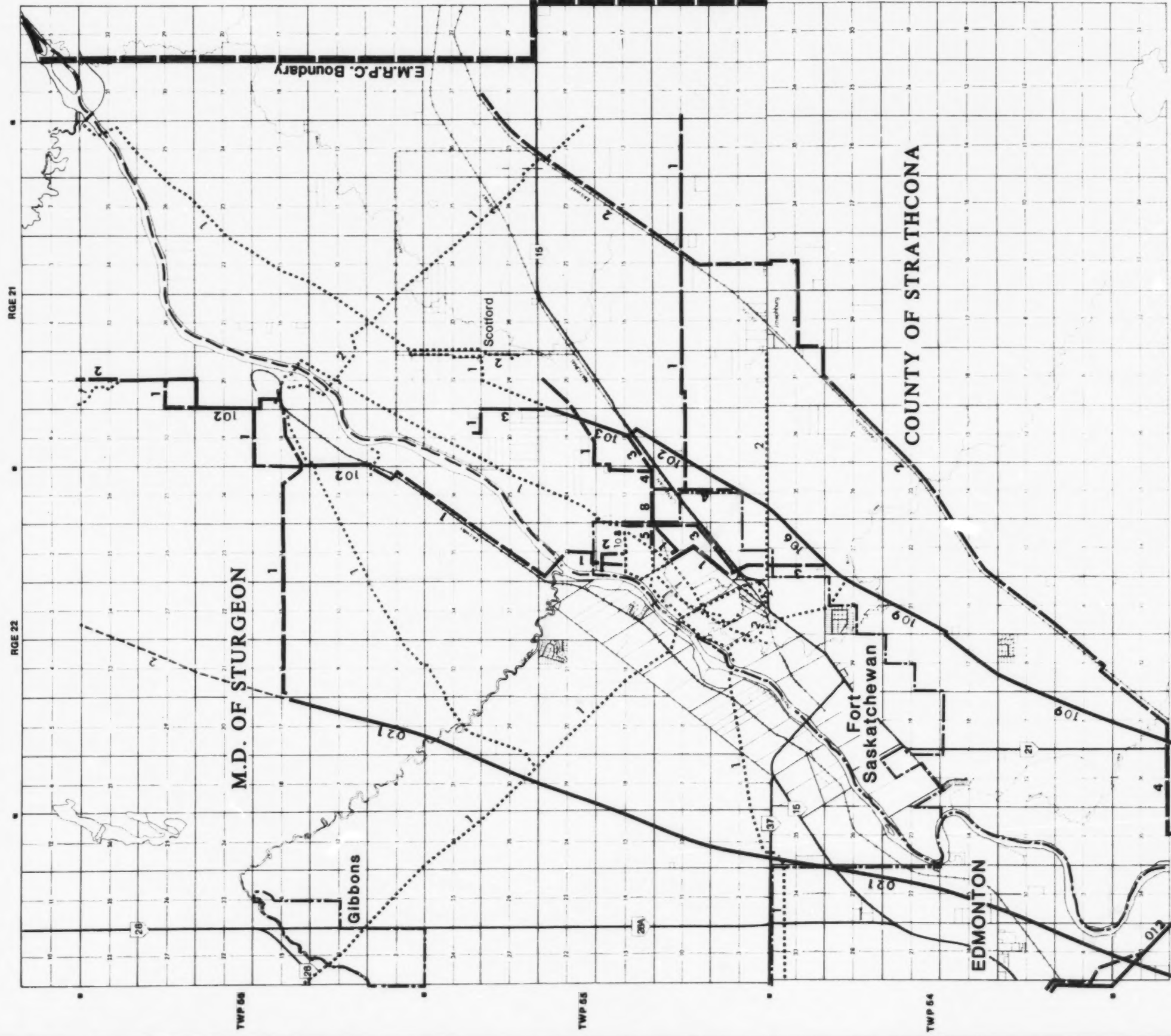
- 1^A GAS PIPELINE
- 2^A OIL PIPELINE
- 3^A PRODUCTS or HVP PIPELINE
- 4^B PIPELINE CORRIDOR
- 021^C PIPELINE ALLEY

- A Indicates number of pipes.
- B High vapour pressure lines carrying various refinery products.
- C Indicates number of pipes of each type in sequence: natural gas, oil, products.
- D Pipeline corridor with undetermined number of lines.

Note: This map illustrates pipelines with a maximum operating pressure over 700 kPa and/or Northwestern Utilities pipelines with a diameter greater than 150mm.

Source: Energy Resources Conservation Board





Major Pipelines NORTHEAST INDUSTRIAL AREA

1^A GAS PIPELINE
 3 OIL PIPELINE
 4^B PRODUCTS and HVP PIPELINE
 021^C PIPELINE CORRIDOR

A Indicates number of pipes.
 B High vapour pressure lines carrying various refinery products.

C Indicates number of pipes of each type in sequence: natural gas, oil, products.

Note: This map illustrates pipelines with a maximum operating pressure over 700 kPa and/or Northwestern Utilities pipelines with a diameter greater than 150mm.

Source: Energy Resources Conservation Board

APPENDIX V - PETROCHEMICAL SECTOR¹

The inventory component of this report identified the petrochemical sector as the dominant form of heavy industrial land use in the Edmonton Region. The intent of this Appendix is to complement the main report with a more detailed examination of the petrochemical sector.

Specifically, the intent here is to document the extent and relative significance of the petrochemical sector in the Edmonton Region, to identify the inter-relationships of producers and products in the industry and to highlight the locational criteria which are fundamental for the development of petrochemical plants. Discussion begins with a brief historical account of the petrochemical industry.

1. Historical Overview

The Canadian petrochemical industry is a relatively recent industrial phenomena which began to develop in a major way in the 1940's in Central Canada. On February 13, 1942, a crown owned company, Polymer Corporation, became Canada's only producer of synthetic rubber and the first manufacturer of various chemical intermediates from petroleum at Sarnia, Ontario.

The second firm to establish in Canada was Dow Chemical of Canada Ltd. Incorporated June 6, 1942, the Dow plant at Sarnia was to produce styrene monomer and ethylbenzene.

The first "real" petrochemical facility in Western Canada came into being with the announcement in 1951 by the Canadian Chemical Company Ltd. (formed by Celanese Corporation of America in 1950) that a petrochemical and cellulose acetate plant would be built at Edmonton. At the time of its construction, it was the largest industrial venture ever undertaken in Alberta and the first major development to use Western Canada's petroleum and natural gas reserves for the manufacture of a range of petroleum chemicals.²

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1. Petrochemical means a chemical compound or element derived mainly from petroleum or natural gas or their derived hydrocarbons and having applications in chemical processing. Source: The City of Edmonton, Business Development Department, The Edmonton Report, Special Petrochemical Issue, October, 1980.
 2. The City of Edmonton, Business Development Department, The Edmonton Report, Special Petrochemical Issue, October, 1980.

In the 1950's, other plants built in the Edmonton Region were: C-I-L, polyethylene (Edmonton); Sherritt Gordon Mines Ltd., nitrogen fertilizer (Fort Saskatchewan); and Borden

Chemical, urea-formaldehyde and phenol formaldehyde resins (Edmonton). Three plants were constructed during the 1960's: Dow Chemical, chlor-alkali, glycol and ethanolamines (Fort Saskatchewan); Esso Chemical, fertilizers (M.D. of Sturgeon); and Thio-Pet, carbon disulfide (Fort Saskatchewan).³

In the mid-1970's the Alberta petrochemical industry began its rapid expansion with many projects around the province developed to use ethane extracted from natural gas.

In 1979, the Alberta complex received a significant boost with the construction of a world scale ethylene plant at Joffre near Red Deer. In the Edmonton Region, further expansions have been undertaken with C-I-L, Sherritt Gordon Mines, Celanese Canada, Borden Chemical and Dow Chemical. In addition, Shell Canada opened a world scale styrene plant and benzene unit (as a component of Shell Refinery) in 1984 at Scotford. Numerous petrochemical plants have been planned for future development in and about the Edmonton Region pending future world markets and economic revitalization.

2. The Alberta Petrochemical Complex

Table A-2 documents the chronological development of petrochemical plants in Alberta and the Edmonton Region dating back to the 1940's.

The table clearly illustrates the relative significance of petrochemical development in the Edmonton Region. Table A-3 further indicates that future petrochemical development in Alberta is likely to continue to build upon the existing pattern of development which, in large part, is focussed upon the Edmonton Region.

The existing petrochemical industry in Alberta has developed into a highly integrated complex of interdependent producers. For example, ethane (feedstock) is separated from natural gas at one of four plants in the province. Ethane is then sent via pipelines to the Alberta Gas Ethylene Plant in Joffre near Red Deer where it is converted to ethylene. Ethylene is sent, again via pipeline, to Dow

3. The City of Edmonton, Economic Development Authority, Edmonton Petrochemical Production, September, 1983.

TABLE A-2
HISTORY OF ALBERTA CHEMICAL DEVELOPMENTS

PERIOD	YEAR	COMPANY	LOCATION	PRODUCTS	CAPACITY KT	APPROX. CAPIT. COST (\$MM)
1940's	1946	Cominco	Calgary	Ammonia	100	4*
				Ammonium Nitrate Urea	20 70	
1950's	1952	Celanese Canada	Edmonton	Formaldehyde	30	137* 25
	1953	C-I-L Sherritt Gordon Mines	Edmonton	Pentaerythritol	26	
				Acetic Acid/Anhydride	73	
	1954	Fort Saskatchewan	Fort Saskatchewan	Polyethylene	30	
				Ammonia	145	
1960's	1956	Western Cooperative Fertilizers	Medicine Hat	Sulphuric Acid	250	49*
				Phosphoric Acid	60	
				Urea	100	
				Ammonium Sulphate	125	
	1957	Borden Chemical	Edmonton	Ammonium Phosphate	425	40*
				Ammonia	60	
				Ammonium Phosphate	160	
				Ammonium Nitrate	60	
	1964	Dow Chemical of Canada	Fort Saskatchewan	Sulphuric Acid	210	1
				Phosphoric Acid	90	
	1965	Western Cooperative Fertilizers	Calgary	Phenolic Resins	10	50*
				Chlor-Alkali	150	
				Glycols	35	
				Ethanolamines	10	
1965 1969	1965 1969	Thilo-Pet Essq Chemical Canada	Fort Saskatchewan M.D. of Sturgeon	HCl	15(100%)	65* 3
				Ammonia	60	
				Ammonium Nitrate	80	
				Sulphuric Acid	360	
				Phosphoric Acid	90	
				Ammonium Phosphate	160	
				Carbon Disulfide	5	
				Ammonia	225	
				Ammonium Nitrate	225	
				Sulphuric Acid	515	
1965 1969	1965 1969	Thilo-Pet Essq Chemical Canada	Fort Saskatchewan M.D. of Sturgeon	Phosphoric Acid	205	80*
				Ammonium Phosphate	425	
1965 1969	1965 1969	Thilo-Pet Essq Chemical Canada	Fort Saskatchewan M.D. of Sturgeon	Nitric Acid	180	
				Nitric Acid	180	

TABLE A-2, continued

PERIOD	YEAR	COMPANY	LOCATION	PRODUCTS	CAPACITY KT	APPROX. CAPIT. COST (\$MM)
1970's	1974	Cancarb	Medicine Hat	Carbon Black	20	7
	1975	Alberta Gas Chemicals	Medicine Hat	Methanol	320	45
	1976	Canadian Fertilizers	Medicine Hat	Ammonia	820	230*
	1977	ComInco	Carseland	Urea	435	
	1977		Carseland	Ammonia	360	
	1977	C-I-L	Carseland	Urea	435	132*
	1979	Dow Chemical of Canada	Fort Saskatchewan	Ammonium Nitrate	225	50
				Vinyl Chloride Monomer	317	
				Ethylene Glycol	191	
				Chlor-Alkali	232	320*
1980's	1979	Diamond Shamrock/Alberta Gas	Scottford (Co. of Strathcona)	Polyvinyl Chloride	100	115*
	1979	Alberta Gas Ethylene	Joffre	Ethylene	545	370
	1980	Celanese Canada	Edmonton	Vinyl Acetate	45	23
	1981	Alberta Gas Chemicals	Medicine Hat	Methanol	400	129
	1982	C-I-L	Edmonton	Polyethylene	35	45
	1982	Celanese Canada	Edmonton	Methanol	700	275
	1983	Esso Chemical Canada	M.D. of Sturgeon	Ammonia	545	
				Urea	500	
				Sulphuric Acid	400	350*
				Phosphoric Acid	70	
	1983	Sheriff Gordon Mines	Fort Saskatchewan	Ammonia	375	350*
				Urea	340	
	1983	Borden Chemical	Edmonton	Formaldehyde resins	20-30+	7
	1984	Union Carbide	Prentiss	Ethylene glycol	230	300
	1984	Alberta Gas Ethylene	Joffre	Ethylene	680	525
	1984	Novacor Chemical	Joffre	LLDPE**	270	450
	1984	Shell Canada Chemical	Scottford (Co. of Strathcona)	Benzene	236	350
				Styrene	300	400
				LLDPE**	160	128
	1986	Dow Chemical of Canada	Fort Saskatchewan			

* Total Capital

+ Solution Basis

** Linear Low Density Polyethylene

Source: Alberta Economic Development, November 1984.

TABLE A-3
PETROCHEMICAL PROJECTS APPROVED BUT CURRENTLY UNDER REVIEW

COMPANY	LOCATION	PRODUCT(S)	CAPACITY (KT)	CAPITAL COST (\$MM)	STARTUP	COMMENTS
Alberta Gas Ethylene	Joffre	Ethylene #3	680	750	1985	Approved. AGEC has announced delay of at least 2 years.
C-I-L/Trlmac	Edmonton	High Density Polyethylene	100	120	1984	Approved. Project deferred.
Celanese Canada	Edmonton	Vinyl Acetate Acetic Acid	400 VAM 340 Acetic	435	1986	Approved. Project deferred.
Shell Canada	Scotford (County of Strathcona)	Higher Olefins	200	400*	1986	Approved. Project deferred.
Peace River Fertilizer	High Prairie	Ammonia	70	50	1984	Approved. Timing under review.
Blewag Energy Resources	Waskatenau	Methanol	2000	650*	1985	Approved. Project is being re-evaluated.
Dow Chemical of Canada	Fort Saskatchewan	Ethylene Dichloride Vinyl Chloride Caustic/Chloride	420 VCM*** 530 EDC*** 550 Chlorine***	135	1984	Approved. Delayed to 1987.
				1890		

* Includes interest during construction.

** Linear Low Density Polyethylene.

*** After expansion.

Sources: Alberta Economic Development, November 1984.

Chemical at Fort Saskatchewan where it is converted to vinyl chloride. Vinyl chloride is taken through a pipeline to nearby Diamond Shamrock/Alberta Gas where PUC pellets are produced. Surplus ethylene is shipped east to other Dow plants.⁴

The Alberta petrochemical industry continues to flourish and, as such, a greater diversity of petrochemical products are being produced in the province. The relationship of such products, their derivatives and finished uses, is rather complex. Figure I, prepared by the Edmonton Economic Development Authority, illustrates the relationship between selected petrochemical products produced both in the region or elsewhere in the province. Excluding the feedstocks and ethylene, many petrochemical intermediates and derivatives are produced in the Edmonton Region.

Petrochemical products are required for a wide variety of manufactured goods including fertilizers, paints, cosmetics, rubber and plastic products. Many of these goods are manufactured in the Edmonton Region although the majority are currently produced in eastern Canada where more established petrochemical sources have, until recently, been mostly located. The Edmonton Region, nonetheless, has tremendous potential for continued growth and diversification of manufactured goods which are by-products of the petrochemical sector.

3. Relative Significance of the Alberta Petrochemical Sector

Comparison of the scale of petrochemical development within Alberta reveals the importance of the Edmonton Region where an estimated 75% of Alberta's petrochemical production is found.⁵ It is similarly useful to compare the relative concentration of the petrochemical industry in the Edmonton Region and Alberta to that in Ontario, Quebec and the remainder of Canada.

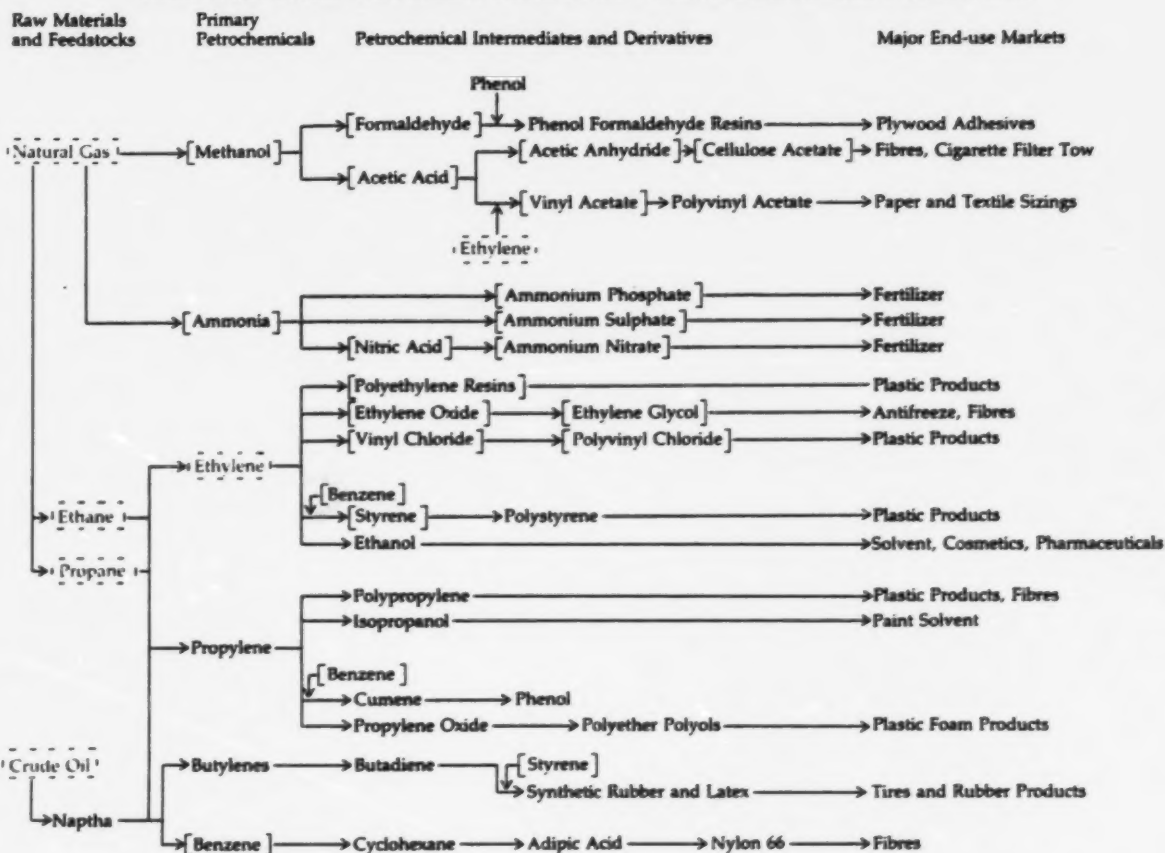
The petrochemical industry presently comprises more than 70 manufacturing plants in five provinces. The largest petrochemical manufacturing centres are found in the Edmonton, Sarnia and Montreal areas.

4. The City of Edmonton, Economic Development Authority, Edmonton Petrochemical Production, September, 1983.

5. Ibid.

FIGURE 1

RELATIONSHIP BETWEEN SELECTED PETROCHEMICAL PRODUCTS



Source: Adapted from Edmonton Economic Development Authority September, 1983

[- - -] Produced or soon to be produced in the Edmonton region
[- - -] Produced elsewhere in Alberta

According to the Petrochemical Industry Task Force, Alberta accounts for 52 percent of current petrochemical production capacity in Canada. The province of Ontario contains 35 percent of the total Canadian production of which an estimated 23 percent is found in Sarnia. Quebec has 9 percent of the total capacity, British Columbia 2.6 percent and Manitoba 1.6 percent.⁶

Table A-4 compares the distribution of petrochemical plants in Alberta with the rest of Canada. Twenty-three percent of all petrochemical plants in Canada are in Alberta, the same number as Quebec, while 42 percent are found in Ontario. However, with 52 percent of the total Canadian production generated from Alberta, clearly the scale of plants in this province and in the Edmonton Region is, on average, substantially larger than those in the east.

For example, by dividing the total production in each part of the country by the number of producing plants, an estimate of the average production per plant can be generated. Using this method, the average production per plant in the Edmonton Region is over 914,000 tons per year. This compares to 492,000 tons in Sarnia and 135,000 tons per plant in Quebec.

Table A-5 sheds further light upon the different types of petrochemicals and where they are produced. Petrochemicals produced in greatest volumes in Canada are ethylene, ammonia and their derivatives. In the Edmonton Region, these petrochemicals constitute 71 percent of total production. The breakdown of total petrochemical production in the Edmonton Region is as follows:⁷

Ammonia derivatives - 33 percent (Esso Chemical, Sherritt Gordon)

Ethylene derivatives - 32 percent (Dow Chemical, Diamond Shamrock, Shell Canada, C-I-L)

Ammonia - 16 percent (Esso Chemical, Sherritt Gordon)

Methanol - 11 percent (Celanese, Borden Chemical)

Benzene - 4 percent (Shell Canada)

6. Petrochemical Industry Task Force Report, February, 1984.

7. Information in Table 4 has been synthesized from the Appendices to the "Petrochemical Industry Task Force Report", February, 1984. For more detailed information, the noted report should be consulted.

TABLE A-4
PETROCHEMICAL PLANTS IN CANADA (a), 1983

LOCATION	NUMBER OF PETRO-CHEMICAL PLANTS	TOTAL ANNUAL PRODUCTION (in tons)	AVERAGE PRODUCTION PER PLANT (in tons)
Edmonton Region	7	6,399,000	914,143
Remainder of Alberta	8	3,542,000	442,750
ALBERTA TOTAL	15 (23%)(b)	9,941,000	662,733
Sarnia	7	3,449,490(c)	492,784
Remainder of Ontario	20	2,757,600(d)	137,880
ONTARIO TOTAL	27 (42%)	5,207,090	192,855
Quebec Total	15 (23%)	2,034,000(e)	135,600
Remainder of Canada	7 (11%)	1,106,500	158,071
CANADA TOTAL	64	18,288,590	301,384

(a) This table does not account for projects which were completed in 1984.

(b) Numbers in parentheses refer to the relative distribution of plants in Canada.

(c) Excludes propane plant which produces 130,000 bbl/day.

(d) Excludes propane plant which produces 400,000 bbl/day. Excludes acrylic plant which produces 7.5 - 8.5 kt.yr.

(e) Excludes ethanol plant which produces 15 million imperial gallons yearly.

Source: Canadian Petroleum Magazine, July, 1983, Volume 24, No. 6.

TABLE A-5
ANNUAL CAPACITIES (1983), THOUSANDS OF TONNES

PRODUCT	EDMONTON REGION	REMAINDER OF ALBERTA	SARNIA	REMAINDER OF CANADA	CANADA TOTAL
Ethylene	-	1,225	705	295	2,225
Ethylene Derivatives	2,047	679	2,443	1,299	6,468
Propylene	-	-	393	171	564
Propylene Derivatives	-	-	326	264	590
Methanol	700	760	-	410	1,870
Methanol Derivatives	87	-	5.5	314	406.5
Ammonia	1,010	1,307	-	1,219	3,536
Ammonia Derivatives	2,132	2118.5	-	2,906	7,157
Butadiene	-	-	198	62	260
Butadiene Derivatives	-	-	251	10	261
Benzene	236	-	431	282	949
Benzene Derivatives	-	-	-	362	362
Toluene	-	-	230	416	646
Toluene Derivatives	-	-	-	154	154
Xylene	-	-	252	196	448
Xylene Derivatives	-	-	-	43	43
Acetic Acid	73	-	-	-	73
Acetic Acid Derivatives	80	-	-	-	80
Butylenes	-	4	79	41	124
Butylenes Derivatives	-	-	250	-	250

Note: This table documents capacities. Actual production may be less.

Source: Petrochemical Industry Task Force Report, February 1984.

Methanol derivatives - 1 percent (Celanese)

Acetic acid - 1 percent (Celanese)

Acetic acid derivatives - 1 percent (Celanese)

The Edmonton Region accounts for 37 percent of all methanol, 32 percent of all ethylene derivatives, 30 percent of all ammonia derivatives, 29 percent of all ammonia, 25 percent of all benzene, and 100 percent of all acetic acid and its derivatives produced in Canada.

4. Locational Determinants⁸

Petrochemicals are produced in many countries throughout the world with the largest concentrations presently found in the United States, Europe, Japan and South America. The petrochemical industry in these traditional locations, however, is stabilizing or even in decline as growth is shifting to other countries including Canada, Saudi Arabia and Indonesia. The two major factors contributing to this trend are costs and the availability of a long term feedstock supply.

Prior to the increase in oil prices in the 1970's, oil was one of the major feedstocks for petrochemical production. However, high oil costs have made alternative feedstocks much more competitive. For example, ethane is a relatively inexpensive feedstock providing an adequate long term supply can be secured. This is the attractive feature of Alberta resulting in the recent growth of the petrochemical industry in the province.

On a comparative basis, Alberta has certain advantages and disadvantages for prospective petrochemical development. On the advantage side, there is an abundant supply of natural gas, coal and oil. These are sources of feedstocks and energy for petrochemical plants representing certain raw material and energy cost advantages. Secondly, there has been a consistent and supportive policy of the Alberta government that encourages investment and diversification of the economic base. This represents a level of political stability not guaranteed in all quarters of the world. Thirdly, the province now has established world-scale petrochemical plants and the availability of a suitable infrastructure, human resources, suppliers of equipment,

8. Ewanchyna, J. E., Polysar Limited, "Locational Factors of Petrochemical Plant Siting", November 1982, Calgary.

services and materials and an extensive pipeline system for oil, gas and gas by-products.

The disadvantages of an Alberta location begin with its almost total reliance upon the export market given the small domestic market in western Canada. The long distribution chain to the marketplace therefore leads to higher distribution costs, less flexibility in product disposition and increases in the risk of contamination.

Another disadvantage is the higher construction costs which may be as much as 15 to 35 percent higher than those on the United States Gulf Coast (excluding currency exchange). Petrochemical plants in Alberta require considerable winterization and special design considerations for cold weather operations. Also contributing to increased construction costs are wage rates which are substantially higher in Canada.

While many of the infrastructure needs of petrochemical industries are already found in Alberta, the level of infrastructure is less developed in Alberta than in eastern Canada or the United States Gulf Coast. For example, it is more common in Alberta to have construction camps and/or significant bussing arrangements. Additionally, the extent of road improvements and long railway spur line installations is generally greater in Alberta. These infrastructure costs have been enhanced in recent years by the provincial government decentralization policy which has contributed to the higher construction and operating costs associated with "greenfield" sites.

Notwithstanding the noted disadvantages, the costs of Alberta feedstocks and products such as ethylene has been low enough to compensate for the much greater distribution costs and other cost disadvantages. This, in turn, has enabled Alberta based companies to be competitive in the world marketplace not only for petrochemical products but as a possible location for new petrochemical plants.

Once Alberta has been chosen as the location to build a petrochemical plant, then a preferred region within the province must be identified. In choosing regions to compare, there are two primary considerations - provincial government policy and the sourcing of feedstocks. Several regions within the province may initially appear to satisfy both of these general requirements. Each of these regions is then evaluated on the basis of all related capital and operating costs, the potential environmental impact, and the socio-economic impact of the plant.

An evaluation of the cost factors would consider:

- (a) cost of raw land, and site development costs;
- (b) sufficient and reliable source of water and cost of its supply;
- (c) waste water and solid waste disposal costs;
- (d) proximity to natural gas and electric power, and the unit cost of these utilities;
- (e) proximity to rail lines and highways, and cost to upgrade them or bring them into the plant site;
- (f) proximity to sources of major feedstocks, and disposition of product and intermediate streams, and the associated cost of pipelines;
- (g) impact of storage costs for hydrocarbons, that is, availability of salt caverns for underground storage versus costly above ground storage in pressure vessels;
- (h) construction cost factors such as labour turnover, construction camps, availability of local services; and
- (i) plant operating cost factors relative to remoteness from major population centres and availability of local services.

The potential environmental impact of the petrochemical plant would consider:

- (a) soil classification to recognize minimum disruption to agricultural land;
- (b) biological capability of the region, with respect to forestry, recreation, ungulates and water fowl;
- (c) water withdrawal rates, disposal of treated effluent, and allocation of water to other uses; and
- (d) effect of normal and fugitive air emissions, including odour.

The socio-economic impact would consider:

- (a) resource use and potential for oil, gas, and coal developments in the region;
- (b) land use plans;

- (c) impact of population increases on community infrastructure and services;
- (d) individual lifestyle choices, such as living in a city, living in a small town, travel time to/from work, remoteness from a large population centre, etc.; and
- (e) level of public interest.

Evaluation of each region will lead to the choice of a preferred region and attention will then focus on selecting a preferred site within that region. The noted factors dealing with cost, environmental impact and socio-economic impact would then be considered in more detail in relation to ease of land assembly, the need for sufficient separation from incompatible land uses, zoning, topography, agricultural land capability, etc.

The evaluation process is assisted by representatives from Alberta Environment and Alberta Economic Development who advise the prospective industry on Government of Alberta policy and concerns regarding region and site selection. Prospective industries will also have discussions with local municipal authorities.

Upon selection of a preferred site and alternative sites, prospective petrochemical industries must submit an application to the Energy Resources Conservation Board (E.R.C.B.) for an Industrial Development Permit (IDP). Before an IDP can be issued, the E.R.C.B. must be satisfied that the information requirements, as outlined in Guide G-25, have been fully complied with, that all interested parties have had an opportunity to express their viewpoints and that the proposed development satisfies the intent of all pertinent legislation and provincial government policy. The requirements of an IDP may lead to the approval of the preferred or an alternative site at which time the site selection process is completed.

Within the Edmonton Region, the Northeast Industrial Areas in Fort Saskatchewan, the County of Strathcona and the M.D. of Sturgeon best satisfy the locational requirements of new large scale petrochemical industries.

5. Future Prospects

The significance of the petrochemical industry in the Edmonton Region is the product of nearly 40 years of development. During the recent growth period in the Alberta economy, numerous new plants and expansions occurred, perhaps the most significant of these being the ethylene plants at Joffre. As a primary petrochemical, the produc-

tion of ethylene in Alberta presents the Edmonton Region and Alberta with many new opportunities for continued growth in the petrochemical sector. This, in combination with the existing petrochemical complex and the long term supply of proven oil and gas reserves, provide a distinct competitive advantage for Alberta and Canada over other countries that are just beginning to enter the industry.

The Alberta petrochemical sector is now a world scale complex and part of a growing movement of petrochemical production away from other industrialized nations, including the United States. Petrochemical development in Canada is largely centred in Alberta and the Edmonton Region specifically and the long term potential for continued growth is very positive.

Municipalities have recognized the importance and potential of petrochemical development and have provided for its future growth in the Northeast Industrial Area. Areas designated for future petrochemical development (see Map 1) are a long term investment which needs to be protected from encroachment of incompatible uses such as large residential or other sensitive land uses. These future heavy industrial areas do not guarantee petrochemical development but provide the opportunity for such development to occur.